ENT

(PUBL

THE

THIRTY-FIRST ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO

1900.

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE.)

PRINTED BY ORDER OF

THE LEGISLATIVE ASSEMBLY OF ONTARIO.

TORONTO:

PRINTED AND PUBLISHED BY L. K. CAMERON.
Printer to the King's Most Excellent Majesty.
1901.

WARWICK BRO'S & RUTTER, PRINTERS.
TORONTO.

EN

To the Hon

SIR,—

Entomo'og

The t

the 13th ar

were electe

proceeding

various bra

various En

The *C*

issued and

world, and

LONDON, ON

THIRTY-FIRST ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY OF ONTARIO

1900.

To the Honorable John Dryden, Minister of Agriculture :

SIR,—I have the honor to present herewith the thirty-first annual report of the Entomological Society of Ontario.

The thirty-seventh annual meeting of the Society was held in the City of London on the 13th and two following days of November, 1900, when the officers for the ensuing year were elected and the necessary business of the Society was transacted. The report of the proceedings includes the audited financial statement of the Treasurer and reports of the various branches, sections and officers of the Society; also the papers and addresses on various Entomological topics presented during the meetings.

The *Canadian Entomologist*, the Society's monthly magazine, has been regularly issued and is now completing its thirty-second volume. Its circulation in all parts of the world, and its value as a scientific publication have been well maintained.

I have the honor to be, Sir,

Your obedient servant,

CHARLES J. S. BETHUNE,

Editor.

LONDON, ONTARIO.

ENTOMOLOGICAL SOCIETY OF ONTARIO.

OFFICERS FOR 1900-1901.

President—Rev. T. W. Fyles, D.C.L., F.L.S, South Quebec.

Vice-President—Professor W. Lochhead, Ontario Agricultural College, Guelph.

Secretary—William E. Saunders, London.

Treasurer—J. A. Balkwill, London.

Directors—Division No. 1, C. H. Young, Ottawa; Division No. 2, J. D. Evans, Trenton; Division No. 3, D. G. Cox, Toronto; Division No. 4, James Johnston, Bartonville; Division No. 5, R. W. Rennie, London.

Directors Ex-Officio (ex-Presidents of the Society)—Professor Wm. Saunders, LL.D., F.R.S.C., F.L.S., Director of the Experimental Farms, Ottawa; Rev. C. J. S. Bethune, M.A., D.C.L, F.R.S.C., London; James Fletcher, LL.D., F.R.S.C., F.L.S., Entomologist and Botanist, Experimental Farms, Ottawa; W. H. Harrington, F.R.S.C., Ottawa; John Dearness, Normal School, London; Henry H. Lyman, M.A., Montreal.

Director Ex-Officio (Ontario Agricultural College)—Professor Wm. Lochhead, Guelph.

Librarian and Curator—J. Alston Moffat, London.

Auditors—J. H. Bowman and W. H. Hamilton, London.

Editor of the Canadian Entomologist—Rev. Dr. Bethune, London.

Editing Committee—Dr J. Fletcher, Ottawa; H. H. Lyman, Montreal; J. D. Evans, Trenton; W. H. Harrington, Ottawa; Prof. Lochhead, Guelph.

Delegate to the Royal Society—Rev. Dr. Bethune, London.

Delegates to the Western Fair—J. Dearness and Dr. Bethune, London.

Committee on Field Days—Dr. Wolverton, Messrs. Balkwill, Bowman, Elliott, Law, Moffat, Percival, Rennie and Saunders, London.

Library and Rooms Committee—Messrs. Balkwill, Bethune, Dearness, Moffat and Saunders, London.

TARIO.

, Guelph.

EVANS, Trenton ;
N, Bartonville ;

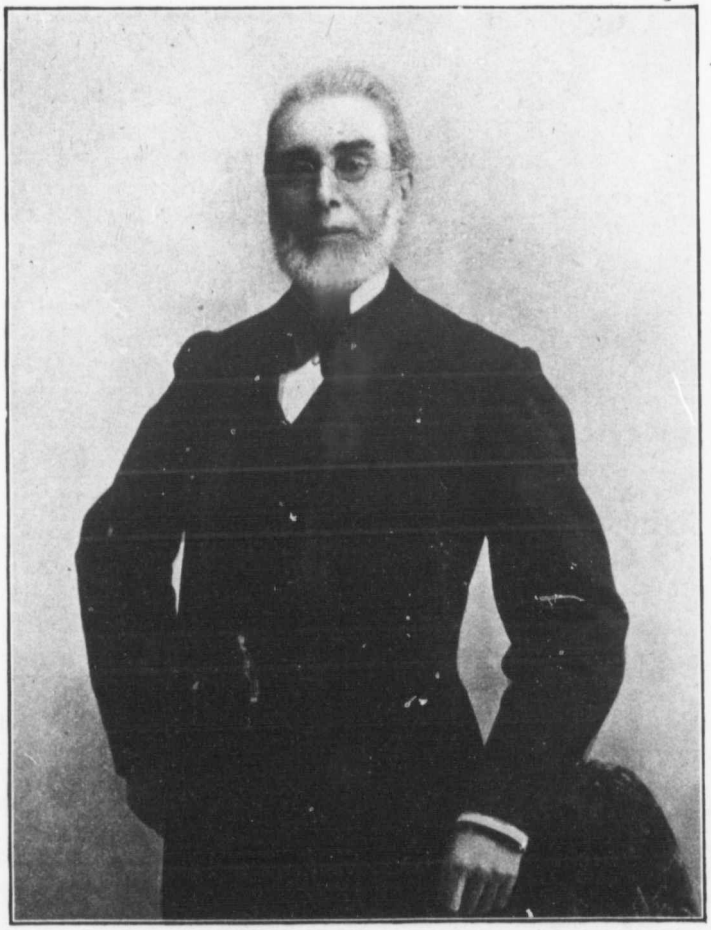
UNDERS, LL.D.,
REV. C. J. S.
L.D., F.R.S.C.,
V. H. HARRING-
; HENRY H.

IHEAD, Guelph.

; J. D. EVANS,

ELLIOTT, LAW,

S, MOFFAT and



J. ALSTON MOFFAT, ESQ., LONDON, ONT.
Librarian and Curator of the Entomological Society since 1890.

CONTENTS.

THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

ANNUAL MEETING.

The thirty-seventh annual meeting of the Entomological Society of Ontario was held in London, the headquarters of the Society, on the 13th, 14th and 15th of November, 1900.

On Tuesday evening, the 13th, a joint meeting was held with the London Horticultural Society in a lecture room at the Normal School. Notwithstanding the inclemency of the weather, a snowstorm prevailing at the time, the hall was completely filled by a very appreciative audience, representing both Societies and the general public as well. The proceedings were much enlivened by instrumental and vocal musical selections kindly furnished by Miss Morphy and Mrs. Edna S. Robb, who was accompanied by Mr. J. W. Fetherston. The Horticultural Society is a new organization which has not yet completed its first year of existence, but has shewn itself to be full of energy and enterprise. Two very successful flower shows were held during the summer and several public meetings at which addresses were given on horticultural and kindred topics. The directors and officers are all members of the Entomological Society and so intimate are the relations between the two that the younger organization may be regarded as a section of the older and larger institution.

The chair was taken by Mr. C. C. James, Deputy Minister of Agriculture for Ontario, who delivered the opening address. He began by explaining the intimate relation that exists between horticulture and entomology, showing that we could have few fruits or flowers if there were no insects, and that there could be no insects if there were no vegetation. While many insects are most beneficial to fruits and flowers, other kinds are most destructive. As noxious or beneficial, the insect world has the closest possible connection with the vegetable kingdom. He then spoke of the various aspects of horticulture and referred, in the first place, to the *labor* side. In the sweat of the brow must the soil be cultivated; no good results can be obtained without hard work, but the earth responds most bountifully when well directed labour is bestowed upon it.

The next aspect is the *financial*. Horticulture must be profitable from a pecuniary point of view, otherwise there would not be so many professionally engaged in it. Their evident success and the expensive character of their equipment shows that they are providing for a real want of the community. All over the country there are extensive conservatories for the production of flowers, and here and there large nursery gardens for the supply of fruit trees and ornamental shrubs and plants.

But is there anything *intellectual* in horticulture? In the early days of this country the pioneer farmers devoted themselves exclusively to the raising of grain, and they began in the same way in Manitoba. All that they produced in excess of their own requirements was bartered for the necessary supplies of their families. After a time the care of cattle and pigs was added to the work of the farm and by degrees, after the lapse of many years, this department grew into the great live stock industry that we find to be so prosperous and so important to-day. The next development was the planting out of a few acres of apple trees and the addition in this way of an orchard to nearly every farm. The benefits derived from this improvement, both in the supply of a most wholesome and agreeable variety for the domestic table and the production of a lucrative crop, were soon realized; more and more land was given up to fruit culture, a higher taste was developed, a more lofty plane of life was reached. The monotonous routine of the early farmer's life was changed to one filled with variety as the seasons came and went, and men found that reading and knowledge were required for the successful prosecution of their varied pursuits. A further mark of progress was the adornment of the homestead with flowers and shrubs. The ornamentation of the home with these objects of natural beauty and the elevation of taste engendered by them indicated the highest stage of country life. The combination of all these things that have been referred to provides a

mode of life that cannot be dull and that requires a high degree of intelligence and ability for its successful prosecution.

Intellectual people, the speaker continued, are much inclined towards horticulture. When such retire with a competence from the business of life they usually find some place on the outskirts of a city or town where there is room for a garden, and there they enjoy their leisure in the cultivation of fruits and flowers. In proof of this devotion to gardening on the part of men who possessed the highest intellectual gifts, the speaker referred to several well-known authors. Blackmore, whose novels hold a place in the first rank, thought more of his fruits and flowers than he did of his books. Rider Haggard not long ago retired to an estate in England, and now he prefers to be spoken of as a farmer or gardener rather than as a writer of fiction. John Burroughs, the charming American writer, shows in his works his devotion to birds and flowers. Charles Dudley Warner lived for ten years in Hartford before he became popular, and then it was due to his papers as an amateur gardener published in the Hartford *Courier*. These attracted much attention and were published in book-form, with an introduction by Henry Ward Beecher, under the now well-known title "My Summer in a Garden."

The greatest Canadian historian is undoubtedly Francis Parkman. Though not a dweller in our country, he devoted himself to the study of its early annals and produced a series of works that cannot be too highly praised for the beauty of their style and the intense interest of their contents. His recently published biography deserves to be widely read; it shows that the great moral of his life was the surmounting of difficulties. Almost blind, crippled with rheumatism, prostrated with nervousness, without a really well day for twenty-five years, he yet managed to accomplish a vast amount of admirable literary work. At the early age of twenty-six he made an expedition along the famous "Oregon Trail" in the search for materials for a contemplated book. The hardships he then endured undermined his health and he was compelled to lay aside his literary work for a time. Horticulture became his exclusive pursuit for several years and by its aid he gradually regained his former health and vigour. He made the growing of roses and lilies his specialty, and at one time possessed a thousand varieties of roses and a great number of hybrids that he had obtained from lilies and other flowers. The meritorious character of his work was attested by his winning no less than 326 awards at the flower shows of the Massachusetts Horticultural Society. In 1871 he was actually appointed Professor of Horticulture by Harvard University and he held the position for a year. After that he returned to his literary pursuits and gained a reputation second to none as a painstaking, accurate historian of the romantic period of the early French regime in Canada.

Horticulture when broadly pursued is an education in itself; it requires undoubted powers of observation and induction, and as it demands intelligence, men of intelligence take a delight in it. It has also a *moral* aspect. Take the case of a boy—if he has a fondness for flowers and fruits, insects and birds, he cannot be an immoral person. His tastes are too high for that; his love for the beautiful things in nature raises him to a higher level and exalts his aspirations far above the sordid things of earth. Believing this to be the result, we can realize how important it is that space should be given in our School system for "Nature Study." It instinctively appeals to the hearts of all children, and by its cultivation leads them on to higher things and makes them better fitted to take their place with their fellows in later life—to do their duty more intelligently, more uprightly, towards their country, their neighbours, and at their own fireside.

THE PLANTING, CARE AND PRUNING OF THE TREES IN THE PARKS AND STREETS OF THE CITY.

By Mr. W. E. Saunders, of London.

The subject upon which I have to speak to you to-night is of great importance from every point of view, and while I only intend to touch upon certain phases, I feel sure the interest you have in the matter will lead you to follow it out in other lines also.

In nature, trees grow in one of two ways—either in a crowded forest, or in places more or less open, where they get plenty of light. Although light is free to all, yet

among the trees it is the only necessary for which they enter a great competitive struggle, upon which their very lives depend. When once started a tree cannot help getting a certain quantity of food and moisture, but unless it receives light also, it dies.

In the forest, trees grow as closely together as they can live, and there is a constant struggle to reach the top; those that succeed in doing so will spread out, and by shading the lower ones, kill them just as surely as though one cut them off with an axe. This method of growth shades the ground closely, keeping it damp and cool, and each year's crop of leaves buries beneath it as it falls the dead limbs and bark chips which fell during the summer and preceding winter, and these, kept always damp by this mulch of leaves, soon decay, and with the leaves themselves form what we know as leaf-mould, the whole process being nature's method of making fertile soil. This is the normal forest condition, and the product of its development is timber, straight-grained, strong and nearly knot-free wood, the joy of the carpenter's heart and one of the best gifts of the Creator to man.

But once in a while, in natural conditions, and more often when the agency of man is involved, a tree gets a chance to grow in a place where there is an abundance of light on all sides, and what result do we find? This tree, instead of growing tall as rapidly as possible, for fear that some competitor will cut off its supply of light, grows broad nearly as fast as it grows tall, and sometimes faster; all sides are covered with leaves, and all the branches beneath are draped with leaves in nature's own unequaled manner. Between these two styles of trees there is little resemblance; the shape is different, the leaves are all over, instead of merely at the top, while the wood, though equally good for burning, is so full of knots from the well developed limbs that it is nearly useless for lumber, but for beauty there is no comparison. The one shows nature in a creative mood making soil and timber for the use of generations yet unborn; and the other shows her in an artistic mood, and the product is something whose beauty is rarely, if ever, equaled by the artifice of man.

Scarcely can the dullest-minded person pass a beautiful tree without rendering his meed of admiration, and many of these growths are of such surpassing beauty that one is tempted to wonder if the Creator could possibly make anything finer, and yet so inscrutable are the ways of some men that they cut, maul, disfigure and distort these gifts of God, and they appear to think that He does not know how a tree should grow and that it is their duty to teach Him.

In our parks and city streets trees are grown mainly for purposes of shade and beauty, and as the coolest and most dense shade is given by the most beautiful trees, namely, those that are covered with leaves above, below and on all sides, it naturally follows that our city trees should be grown in this form. And there is but one way to grow them after this manner, and that is by giving them plenty of light, and keeping the trimming fiend at a distance.

In Victoria Park, young as it is, many trees are at this moment ugly and deformed by a want of observance of these conditions, light and trimming, and, in fact, one can see there some of the most striking examples of how not to grow a tree that can be found in a long journey. But it seems invidious to single out Victoria Park, when one can see in any part of the city glaring examples of distrust in the Creator's good taste and ability to grow a tree properly.

To many people who do their own pruning and do a good deal of it, the idea may not have occurred that nature really intended certain trees to grow in certain forms, and that no matter how they may be pruned, that form will always be the ultimate aim of the tree. They fail also to realize that the hand of God is omnipotent, and that their best endeavours will only mar the perfection of beauty into which a tree would come if permitted to follow its natural bent.

The love of trees is implanted deep in the nature of nearly every person. Many people do not realize this until they come into possession of a plot of ground, where a few trees are growing, when their natural affection comes quickly to the surface. But few, however, have this feeling so chastened with wisdom as to enable them to treat their trees well; nearly all want to grow two, three or even a dozen trees in the space that shodld be given to one, not realizing how much better it would be to have one fine, large, well-shaped, handsome tree, than to have half a dozen stunted, mis-shapen, lopsided ones, whose only real utility is for consumption as fuel. No better proof of this deeply im-

planted love can be offered than the fact that it is almost impossible to persuade the average man to part with a single one of his trees, even when the destruction of one means the betterment of the others.

Occasionally, however, one sees a tree, even in London, that has had unlimited chance to develop, and the owners of these grand trees declare them to be without price; but these beautiful examples are all too few. The other extreme is everywhere, and perhaps the most flagrant case in London is in front of the Collegiate Institute. There stand three or four rows of trees, not one of which is now, or has any prospect of ever being anything but an eyesore, and yet those trees are old enough and have used enough nourishment from the soil and light from above to have made trees as handsome as any in the city had they been given proper opportunity. They are now so far gone that it would be almost impossible to make a really fine tree out of a single one of them; and what has occurred here is in process of occurring all over where from two to ten trees are planted in the space which one large, well-grown tree will need in twenty-five years.

At irregular intervals a man, called by courtesy a "tree-pruner," more or less authorized by those who rule over us to butcher every inanimate object, travels through our streets and makes a bad matter still worse.

A gentleman living near my house had last summer a very handsome cut-leaved birch and a good many maples growing on his front lawn. Noticing that the birch was beginning to suffer from being overcrowded, I one day complimented him on the beauty of his tree, and suggested that it needed more room in order to retain its beauty. He replied that it was a very nice tree, but it needed pruning, and he was getting a man who understood such things to come and see to it. The beauty of this species of birch lies in the long, slender, drooping branchlets, and in the handsome pyramidal shape of the tree; but this "pruner" sawed off the trunk of this tree at about eight feet from the top, sawed one-third off the larger limbs, and left the tree shorn of all its beauty and with the work of years destroyed. All the tree needed was to receive plenty of light and to be left alone. Such examples are abundant.

I notice lately that the tree pruner is getting in his deadly work at Springbank also. Within the past year or two the birches, poplars, maples, etc., near the pump-house have had from two to five feet taken off most of their branches, and from the trunk also. The object of this treatment is undiscoverable. The spruces, too, in other parts of the grounds, are receiving similar attention, and of all trees the spruce needs pruning least, and bears it worst. A pruned spruce is no longer a spruce, but an abortion, unlike anything in nature and is fit only for the brush pile, for it will never be itself again.

When trees are too many, cut some of them down. A tree which is too large for its environment can never be made handsome by any system of pruning, and not only that, it will spoil others which might be ornamental if its space were vacant.

Now, a word as to the planting of shade trees. In London we suffer from a superfluity of silver maple (Acer dasycarpum). This is a quick growing tree of handsome form, but there are others that are as quick growing and many that, though slow growers, are more desirable and very handsome. Our streets should not all be planted with one kind of tree. Monotony should be avoided. Besides, when a blighting disease or a devastating insect, affecting possibly only one species of tree, reaches a city planted with that tree only, that place is liable to have very few good trees left. Some twenty-five years ago the streets of London had many locust trees, whose foliage and flowers are both beautiful, but the locust borer came among them and now they are gone. The maple is a grand tree, hardy and nobly beautiful, but we have many other fine trees also, and doubtless it was never intended that we should confine ourselves to the use of one species only. The birches, three or four species of beautiful trees, immortalized in poetry and characteristic of the north; the lofty elm, whose fame as a street tree in New England has spread over the entire continent; the fragrant basswood, the evergreen spruces and cedar, the hemlock, which I sometimes think is the handsomest of all our trees, and the nut trees, chestnut, butternut, walnut, beech and the hickories—all these and many more have beauties of their own, and should be largely used, particularly the nut class, which render the parks attractive to the squirrels and the birds and the children, and is it not for the children, particularly those of the poorer people, for whose use the parks should mainly exist? I have no patience with the park regulations which say to the children, "Keep off the Grass." Rather

let them say, "Boys and girls, this park is for you; don't destroy it, but enjoy it in every possible way." Some day I hope we shall see this principle recognized.

Beauty in the streets and parks is an asset, and should be well looked after, as it is perhaps the greatest attraction a city can have, next to a low tax rate; and although we have to-day many thousands of spoiled, ugly trees, fit only for the woodpile, yet there are thousands more growing up, and intelligent care can prevent most of them from following the example set by their elders.

These points upon which I have touched affect not only our own city, but almost every city and town in our country; and the need for intelligent care is urgent.

It was only a few weeks ago that an eminent horticulturist wrote in the pages of *Gardening*, a leading American magazine, of the folly of planting trees in rows along the drives in parks, a method which is the worst possible, for besides spoiling the artistic appearance of the place, it prevents the people on the drives from the realization and the enjoyment of the beauties of either the nearby or the distant view, and yet, despite of the fact that this principle is freely stated and admitted by the best authorities, it is the very method which is being adopted in our river park, now in process of formation; and not only that, but the chief part of the trees planted have been soft maples and Norway spruces, the very ones of which Londoners have already far too many. It is to be hoped that ere long different methods may prevail, and while there is yet time the best may be made of the material now planted, and that the future may be properly provided for by the planting of such trees as will lend variety and beauty to the landscape. How this is to be accomplished is not difficult to tell, for it can only be done by placing the control of such matters in the hands of men who have given thought and study to the subject. Were our own city council, for instance, to appoint for 1901 a committee consisting of a few such men, and to give them a free hand in the matter the effect on the appearance of our city parks and streets would be great and lasting.

I have not touched upon the matter of shrubs and flowering plants, but it would be easy to make a great improvement over present conditions were the plan above mentioned to come into action, and no plan would be complete that did not aim at the best results in these points, as well as others; but a shrub may be at its best in five or ten years, whereas a tree is the growth of decades, and neglect for ten years may ruin the result of twenty-five years' careful work and thought.

Dr. James Fletcher, Dominion Entomologist and Botanist, Experimental Farms, Ottawa, was the next speaker. His address was illustrated with beautiful lantern pictures, which gave great pleasure to the audience. The excellent lantern was kindly provided by Mr. Merchant, Principal of the Normal School, who was assisted in its manipulation by Mr. R. W. Rennie.

Dr. Fletcher first presented a series of pictures in illustration of the paper that had just been read by Mr. Saunders and showed how trees should be grown and treated, giving as examples specimens that were growing on the Experimental Farms at Ottawa and in the North-West. Many of these were from photographs taken on the grounds of the Experimental Farm at Ottawa, and had been specially lent for the occasion by Dr. William Saunders, the Director. Among others he exhibited the Black Walnut, Russian Poplar, Austrian Pine, Blue Spruce, Scotch Pine, Cutleafed Birch, and some very remarkable trees in the Rocky Mountains and in British Columbia; he also showed some beautiful flowering shrubs and other interesting plants, the Hydrangea paniculata grandiflora, Spiræa van Houtei, Mary Arnott Rose, Charles X Lilac, Cypripedium spectabile, etc.; the Devil's Club (a most troublesome plant to mountain climbers), Hedges on the North-West Experimental Farms, Dr. Saunders's Hybrids from Apple and Pyrus baccata; the method of spraying trees at Ottawa.

He then took up the subject of insects, showing how those that are injurious may be divided into two great classes according to the mode in which they partake of their food, namely the biting (those furnished with jaws) such as caterpillars, grubs, beetles, &c., and the sucking (those provided with a beak or sucker), such as mosquitoes, aphides, bugs, &c. The former can be destroyed by poisoning their food with such substances as Paris green, hellebore, insect-powder, &c., but the latter cannot be reached in this way, and must be subdued by substances that will smother them when applied to their bodies, viz., kerosene emulsion, whale-oil soap, &c. The many beneficial species of insects, such as lady-birds, ichneumons, carnivorous ground-beetle, which prey upon cut-worms, and

many others, ought to be familiar to all, so that they should not be wantonly trodden under foot or otherwise destroyed. Excellent figures of all those referred to were shewn upon the screen, and a large number of our most prevalent insect pests, among others, the cabbage-root maggot, the devastating and climbing cut-worms, the May beetle (white grub), pea-weevil and pea-aphis, pear psylla, eye-spotted bud-moth, canker and palmer worms, the cigar case-bearer, plum sphinx and curculio, grape-vine flea beetle, spruce gall-louse, tent caterpillars, codling moth, San José scale, and the lovely Luna moth. Each picture as it appeared was briefly described in the speaker's well-known graphic and often humorous manner, and the interest and attention of the large audience were maintained to the last.

At the close of Dr. Fletcher's address, the following resolution was proposed by Dr. Bethune, who spoke briefly in its support, and seconded by Principal Kirk; on being put to the meeting, it was unanimously adopted:

"That this meeting of the Horticultural and Entomological Societies endorses the idea that the control of the city's horticulture should be in the hands of men who have made this science a study; and that this meeting urges upon the City Council the advisability of placing in the hands of a small committee of citizens the entire control of the shade trees on the streets and in the parks of London, believing that in this way only can the best results be accomplished; and that the secretaries of the two societies are hereby instructed to send copies of this resolution to the Mayor and the City Clerk early in January, 1901, asking that it be brought before the Council at the earliest possible moment, and requesting that action be taken thereon."

At the conclusion, votes of thanks were tendered to the ladies for the musical treat that they had afforded; Professor James and the other speakers for their interesting addresses; Professor Lochhead, for the loan of a number of slides; and Principal Merchant, for the use of the Lecture room and lantern, and the kind assistance that he and Mr. Rennie had afforded.

WEDNESDAY, NOVEMBER 14TH.

The Council of the Entomological Society met at 10.30 a.m., for the transaction of business and the preparation of their report on the proceedings of the past year. The President occupied the chair, and the meeting continued in session till one o'clock.

The Society met at 2.30 p.m. Among those present were the following: Rev. Dr. Fyles, South Quebec, President; Prof. Lochhead, Ontario Agricultural College, Vice-President; Dr. James Fletcher and Mr. Arthur Gibson, Experimental Farm, Ottawa; Mr. Henry H. Lyman, Montreal; Inspector G. E. Fisher, Freeman, Ont.; Prof. F. M. Webster, Wooster, Ohio; Revs. Provost Watkins, and Dr. Bethune, London; Drs. Woolverton and Stevenson, and Messrs. J. A. Balkwill, J. H. Bowman, J. Dearness, H. Gould, B. Green, C. J. Fox, W. Gammage, W. H. Hamilton, John Law, Heard, J. A. Moffat, S. B. McCready, W. E. Saunders, R. W. Rennie, E. A. Brown, H. S. Saunders, and many other residents of London.

The President called upon the Directors and Officers of the Society, the representatives of the Branches, and the chairmen of the Sections for their respective Reports on the work of the past year. These were read and discussed, as follows:

REPORT OF THE COUNCIL.

The Council of the Entomological Society of Ontario begs to present its Annual Report for the years 1899-1900.

The thirty-sixth annual meeting was held in London in October 1899, and was well attended by members from a distance as well as by those resident in the city. An interesting and important addition to the ordinary proceedings was a conference held during the first afternoon on the San José Scale and the operations that had been carried out for its suppression in the Province of Ontario. A full report of the discussion and of the subsequent proceedings at the meeting has already been published; it is therefore unnecessary to enter into particulars.

The thirtieth Annual Report on economic and general Entomology was presented to the Minister of Agriculture for Ontario in December last and was printed and distributed in the following March. It contained 127 pages and was illustrated with sixty-six wood cuts and two plates, one a portrait of Mr. Henry H. Lyman the retiring President, the other exhibiting the structure of a butterfly's wing. Besides the account of the conference on the San José Scale and the proceedings at the Annual Meeting, it contained among many useful papers, the President's address by Mr. Lyman; "One hundred years of American Entomology" and "The home of the San José Scale" by Prof. F. M. Webster; papers by Prof. Lochhead, Mr. Arthur Gibson, Mr. J. A. Moffat, Dr. Bethune, Mr. W. N. Hunt, Dr. Fyles, and articles on the most notable and injurious insects of the year by Dr. Fletcher, Messrs. Harrington, Evans, Moffat, Gibson and Drs. Fyles and Bethune. An addition of much interest was the report of the proceedings at the first annnal meeting of the North-West (Canada) Entomological Society, held at Lacombe, Alberta, in November 1899.

The *Canadian Entomologist* has been regularly issued at the beginning of each month. The 31st volume was completed in December last; it consisted of 377 pages, illustrated with 36 wood cuts and six plates. The contributors numbered no less than sixty, and included well-known writers in England, Germany, Finland, Brazil and Japan, as well as in the United States and Canada. The thirty-second volume will be completed next month; the eleven numbers already issued contain 352 pages and many original illustrations.

An index to the thirty Annual Reports of the Society, 1870 to 1899, has been prepared by the Rev. Dr. Bethune and is now being printed under the direction of the Department of Agriculture. It is expected to be ready for distribution before the end of the year, and will, undoubtedly, be found of very great value by all who have occasion to consult these Reports.

Entomological meetings have been held regularly on Friday evenings, at first fortnightly, afterwards weekly, from October to June, and have now been resumed for the autumn and winter seasons. The study of the Lepidoptera was taken up for several months and when spring opened specimens freshly captured were brought for identification and discussion. The order Coleoptera has been adopted for study during the sessions that have now begun.

The Council is glad to be able to report that the Ornithological Section has been revived and has held regular monthly meetings for a year past; at the same time it has to express its regret that no meetings of the Botanical Section have been held this year. The Geological Section has been as active as usual, holding weekly meetings on Tuesday evenings throughout the greater part of the year, and the Microscopical Section has held interesting meetings on alternate Friday evenings during the autumn and winter months.

Many valuable and interesting additions have been made to the Library and Collections. The Council desires to bear its testimony to the great care taken by Mr. Moffat in the preservation of the Society's books and specimens, and their neat and orderly arrangement. Too much praise cannot be accorded to him for the zeal and interest that he always displays in attending to the welfare of the Society and the good order of its property.

All of which is respectfully submitted.

THOMAS. W. FYLES, President.

REPORT OF THE LIBRARIAN AND CURATOR, FOR THE YEAR ENDING 31ST OF AUGUST, 1900.

Thirty bound volumes of Government Reports, and proceedings and transactions of societies were received during the year. Among them were twelve quarto volumes of the United States Geological Survey, profusely illustrated, with a volume of maps accompanying them.

Thirty-four volumes were bound and added to the library. Among these are some volumes of the Bulletins of the Iowa University (a gift to the library by Rev. Dr. Bethune) one of which is of special interest, being explorations in the Canadian Far North in search of the Musk Ox, by Frank Russell. Also contributions from Drs. Fletcher and Bethune of volumes of the Proceedings of the American Association for the Ad.

vancement of Science, which complete the Society's set up to date, and make the number of volumes added during the year 64.

The full number now on the register is 1,691.

Number of volumes issued to local members was 45.

A few additional specimens of Manitoba Lepidoptera have been secured since the last report, which are valuable for reference and comparison.

Nothing of special interest in local captures can be reported for the past season. A few doubtful forms are awaiting determination. Mr. O. C. Poling, of Quincy, Illinois, has kindly and considerately presented to the Society, a fine pair of that rare, singular and interesting butterfly, *Neophasia Terlootii*, Behr., taken in Arizona.

Respectfully submitted.

J. ALSTON MOFFAT.

AUDITORS' REPORT.

Receipts and Expenditures of the Entomological Society of Ontario, for the year ending August 31st, 1900:

RECEIPTS.		EXPENDITURES.	
Balance, September 1st, 1899....	$ 576.30	Cork, pins, etc.....	$ 45.20
Sales of Entomologist	150.69	Expense acct.,(Postage, etc.)....	159.79
Sales of Cork, pins, etc.....	93.58	Library	35.89
Advertising	14.35	Salaries	375.00
Government Grant	1,000.00	Annual Meeting and Report....	254.60
Members fees.....	439 86	Rent.....	175 00
Interest	13.16	Printing	749 75
		Balance on hand Aug. 31st, 1900,	492.71
	$2,287.94		$2,287.94

We, the Auditors of the Entomological Society of Ontario hereby certify that we have examined the books and vouchers of the Treasurer and find them correct, and that the above is a true statement of the accounts of the society.

W. H. HAMILTON }
JAS. H. BOWMAN } Auditors.

London, Ont., Sept. 18th, 1900.

REPORT OF THE MONTREAL BRANCH.

The 224th Regular and 27th Annual Meeting of the Montreal Branch of the Entomological Society of Ontario was held at 74 McTavish street on Tuesday evening, May 8th, 1900.

The members present comprised Messrs. A. F. Winn (Pres.), Henry H. Lyman, A. E. Norris, E. T. Chambers, J. C. Williams, G. Chagnon, G. Beaulieu, M. W. Davis, C. Stevenson, G. A. Moore, C. P. Newman and L. Gibb. Visitor—Rev. E. C. Trenholme.

The chair was taken by the President and the minutes of the previous meeting, and also of the last annual meeting, were read and confirmed.

REPORT OF THE COUNCIL.

The President then submitted the following report of the Council for the past year:

In presenting their report for the past year your Council is pleased to be able to state that much good work has been done.

Eight regular monthly meetings have been held, the average attendance being ten, and six new members have been added to our roll.

We have again had a visit from each of our good friends, Dr. Fletcher and Rev. Dr. Fyles, in addition we had the pleasure of having Mr. J. G. Jack of Jamaica Plains, Mass., at one meeting and one of our new members, Mr. E. D. Wintle of Como, P.Q., has come to our meetings regularly.

Two field days were held, the first at Beloeil Mountain, St. Hilaire, on May 24, which was very successful, many valuable specimens being secured; the other at Chateau-

guay on July 1st was made a most enjoyable outing, through the kind hospitality of Mr. and Mrs. Jack and their family, but the captures were disappointing owing to the strong wind which was blowing all day. Several members also attended the Natural History Society's field day at Montford.

The following papers were read at the meetings:

Retiring Address of the President—Henry H. Lyman.
Collecting at Electric Light—A. F. Winn.
Note on Emergence of Telea polyphemus—M. W. Davis.
The Genus Hydroecia—Dwight Brainerd.
Spiders—Rev. Dr. Fyles.
A Sketch of the Order Orthoptora—E. M. Walker (of the Toronto Branch).
Tribulations of a Beginner—Dwight Brainerd.
Practical Entomology, or Bee Keeping—Gilbert Wintle.
Bees and Wasps—Dr. Jas. Fletcher.
An Entomological Muddle—Henry H. Lyman.
Chrysophanus thoe—A. F. Winn.
On the Rearing of Lepidoptera—Arthur Gibson.
Danais Archippus—A E. Norris.

This list probably shows more diversity of subjects than that of any year in the history of the Branch, and the specimens shown at the meetings have included orders that have been little studied here in the past, such as Diptera, Hymenoptera and Orthoptera.

Our collection of books has again been added to by Mr. J. G. Jack, who has presented copies of the report on the Gypsy Moth and two volumes of Memoirs of the Academy of Natural Sciences. A case has been ordered for our books and pamphlets, and the Natural History Society have kindly consented to give us space for it in their building.

The Treasurer's statement shows the Branch to be in a good financial position.

Respectfully submitted on behalf of the Council,

ALBERT F. WINN, President.

The Treasurer then submitted his report, showing a balance on hand of $59.37.

It was moved by Mr. H. H. Lyman and seconded by Mr. C. Stevenson "That the reports of the Council and of the Treasurer be received and adopted." Carried.

The following officers were elected for the ensuing year: President, A. F. Winn; Vice-President, Dwight Brainerd; Secretary, Lachlan Gibb; Treasurer, M. Waring Davis; Librarian, A. E. Norris; Council, H. H. Lyman and G. Chagnon.

Mr. Henry H. Lyman read a paper on the Life History of Euchaetes Oregonensis, and also exhibited a pamphlet entitled Memoirs of the Chicago Entomological Society.

A letter was read from E. Brunetti, London, England, asking for exchange in Canadian Diptera, which was referred to Mr. Chagnon.

After examining a number of specimens shown by the members the meeting adjourned.

LACHLAN GIBB, Secretary.

REPORT OF THE QUEBEC BRANCH.

The annual meeting of the Quebec branch of the Entomological Society of Ontario was held on May 12th, 1900, the president, Rev. Dr. Fyles, occuping the chair.

PRESIDENT'S ADDRESS.

The Quebec branch of the Entomological Society of Ontario has entered upon the fourth year of its existence. During the past year several things have happened to occasion our members much concern.

Death has removed two from amongst us. Mrs. Treffry departed this life a few months ago; and on April 27th, Mr. Treffry after a very brief illness was also taken

away. We shall miss the active interest he took in our affairs. His ability as a journalist and his ready pen were often exercised in the interests of the Branch and his cheerful good-nature, before sorrow overtook him, added to the interest of our meetings.

Next we have to record the closing (temporary it is to be hoped) of Morrin College. The reduction of the grant from the Superior Education Fund, the inadequacy of the number of paying students to make up for this, and the failure of support from our decreasing English speaking population, militated seriously against its interests and made it impossible to maintain its very efficient staff of professors without trenching too far upon the capital funds of the Institution. We hope that the privilege of meeting in the College rooms will still be allowed us.

The late principal, Dr. Macrae, and Professors Clark, Gunn and MacIntyre took a kind interest in our proceedings; and in Professor Walters we have had a firm friend and valuable member. Should he be called from the city, we shall regret his departure deeply at the same time that we shall indulge the hope and heartily pray that health and prosperity may attend him and his family wherever their lot may be cast.

An untoward accident in the beginning of March interfered for two months with the regular course of the proceedings of the branch, but before that its meetings were regularly held and well attended.

Four field days were held in the course of the summer: two at the Gomin; one (by invitation) in the grounds of E. H. Wade, Esq., at New Liverpool and one at the Island of Orleans.

At the meetings in Morrin College, the following subjects were considered:—Noah's Flood and the Insect World: Ichneumon Flies; Dragon-Flies; "The Kissing Bug"; the Hemiptera; the Ceratocampidae and the Saturnians.

At one of the meetings a most interesting narrative of an entomological expedition to the country north of Brandon, Man., written by Mr. A. Hanham of Winnipeg, was read and fully appreciated. At another meeting many very beautiful southern moths presented to the president by Mr. H. H. Newcomb of Boston were exhibited and greatly admired.

Among the interesting captures of the season were: *Thyatira rectangulata*, Ottolengui, which was taken on the Island by Mrs. Turner; a fine specimen of the salmon-colored variety of *Hepialus argenteomaculatus*, Harris, taken at light at St. Paul, Quebec; *Catocala Bianca*, Hy. Edwards, also at light at Levis; and a very fresh specimen of *Ufeus Satyricus*, Grote, caught on the wing at the Chaudière, on the *20th of January* by Mr. Charles Barclay.

A new pest has made its appearance in this province viz: the American Cockroach (*Periplaneta Americana*), a specimen of which was found at St. Paul, Quebec, on the 21st of April. This makes the fourth kind of cockroach that has shown itself in Quebec Province. The other three are the German Cockroach (*Ectobia Germanica*); the Oriental (*Blatta orientalis*) and the Australian (*Periplaneta Australasia*). All these insects are troublesome and disgusting, but they are incapable of inflicting personal injury. A very effective trap for them may be purchased in the hardware stores. Rapid and constant intercourse with all parts of the continent will doubtless bring many insects within our borders.

By far the worst pest that of late years has shewn itself in Canada is the San José Scale. Up to the present time it has not been found in the Province of Quebec; but in Ontario its ravages have occasioned much dismay. Fortunately the Ontario Government are aware of its dangerous character and are taking timely and stringent measures to check its course. The report of a very interesting discussion upon this scale is printed in the Society's Annual Report which will shortly be in the hands of the members.

It is to be hoped that the coming season will be a favorable one from an entomological point of view; that no troublesome insects may increase to cause alarm and that many rare and beautiful specimens may reward the efforts of our collectors.

Report of Council.

The branch now includes 43 members: 33 adults and 10 juniors.
The Treasurer's report gives a very satisfactory showing.
Several excursions were made during the year and were very successful.

Owing to an accident to our worthy president the course of lectures had unfortunately to be interrupted to the great regret of the members.

Our thanks are due to the authorities of Morrin College for having continued to allow us to use their rooms for our meetings.

H. WALTERS, on behalf of the Council.

It was moved by Miss Hamel, seconded by Mrs. Poston, and unanimously resolved that the thanks of the meeting be tendered the council and the officers.

The following were then elected :

President, the Rev. Dr. Fyles.

Vice-President, Miss E. MacDonald.

Council, Mrs. R. Turner, Mr. James Geggie, Professor Walters, Hon. R. Turner, Miss Bickell, Miss Winfield.

Secretary-Treasurer, Lt.-Col. Crawford Lindsay.

Curator, Prof. Walters.

Since the above report was written Morrin College has been re-opened, and has a large attendance of students. The Quebec Branch of the Entomological Society of Ontario has commenced its regular work and is in a very healthy condition. At the last meeting twenty-two members were present and four new members were elected. Before the close of the season it held a happy field-day in the grounds of James Geggie, Esq., at Darnoc, Quebec.

THOMAS W. FYLES,
President of the Quebec Branch.

REPORT OF THE TORONTO BRANCH.

The fourth annual meeting of the Toronto Branch of the Entomological Society of Ontario was held in the Education Department (Normal School), on Friday evening, the 6th April, 1900.

The following members were present : Messrs. E. M. Walker (Vice-President), G. M. Stewart (Secretary-Treasurer), H. C. Austin (Librarian), D. G. Cox, R. J. Crew, C. H. Tyers and S. R. Carter ; visitor, Mr. A. Cook.

In the absence of the President, the Vice-President took the chair.

The minutes of the previous regular meeting were read and approved.

Messrs. Geo. Smith, Geo. Rossiter, Albert Cook and W. H. Harrison were duly elected members of the Branch.

The Secretary read the following report of the Council for the year ending 31st March, 1900 :

REPORT OF COUNCIL.

The Council of the Toronto Branch of the Entomological Society of Ontario take much pleasure in presenting the Fourth Annual Report of the proceedings of the Branch for the year ending 31st March, 1900.

They are pleased to report that since the last annual meeting the membership of the Branch has been increased by the addition of one new name, viz , Mr. D. G. Cox, and as some of the meetings have been attended by visitors, no doubt others may be induced to take an interest in our work in the near future.

During the past year fifteen regular meetings have been held in the Education Department, with a fair average attendance of the members. The Council is pleased at the result of Mr. Lyman's suggestion that papers be exchanged between the Toronto and Montreal Branches, and is much indebted to the members of the latter Branch for the interesting papers so kindly contributed. As a partial return, Mr. Walker's paper, mentioned below, was forwarded to be read before the Montreal Branch.

The following is a list of the papers read before the Branch during the past year :

Annual Address of the President, Mr. R. J. Crew.

Notes on Danais Archippus, Mr. H. H. Lyman, of the Montreal Branch.

A Sketch of the Order Orthoptera, with special reference to the Ontario Forms, Mr. E. M. Walker.

Collecting at Electric Light, Mr. A. F. Winn, President of the Montreal Branch.

The Rearing of Lepidoptera, Mr. Arthur Gibson.

Notes on the Anatomy of Belostoma, Mr. G. M. Stewart.

An interesting feature of the year's work was an open meeting held on the 5th of January, at which a large audience was present, including many Normal School students. Dr. Fletcher, of Ottawa, Dominion Entomologist, gave a most interesting lecture on "Bees and Wasps." Dr. Bethune, of London, editor of the *Canadian Entomologist*, also gave an interesting address on the aims of entomology, and spoke of the work being done by the Entomological Society of Ontario and its Branches.

During the year several field days were held and many interesting captures were made.

The work of classifying the collection of insects made by the Branch for the Education Department is progressing well, and it is gratifying to know that the species already collected and donated have been transferred into the cases, in the Department. During the coming season the Council would urge the members to collect largely so that by next winter the Department may be in possession of a fairly good reference collection of the insects of Ontario.

The report of the Librarian shows that many valuable Government publications have been added to the library, also that two periodicals have been subscribed for, and several books purchased during the year.

The Treasurer's report shows a small balance carried forward on the right side.

Respectfully submitted on behalf of the Council.

ARTHUR GIBSON,
President.

The report of the Treasurer was then presented, as was also that of Mr. Austen, as Librarian, and on motion the reports of the Council, Treasurer and Librarian were duly adopted as read.

The election of officers for the ensuing year resulted as follows: President, Mr. D. G. Cox; Vice President, Mr. E. M. Walker; Secretary-Treasurer, Mr. G. M. Stewart; Librarian, Mr. H. C. Austen; Members of Council, Messrs. R. J. Crew and C. N. Tyers.

The address of the retiring President, Mr. Arthur Gibson, was read by Mr. Walker, Mr. Gibson, owing to his duties as assistant in the Division of Entomology at the Central Experimental Farm, Ottawa, being unable to be present. The work of the Branch since its inception was reviewed, particular attention being made of the year just ended. The members were urged to make extra efforts the coming summer to collect and mount specimens for the collection which the Branch is forming for the Educational Department for Ontario. The latter portion of the address took the form of a practical illustrated paper on "The Preservation of Larvæ by Inflation."

A vote of thanks to Mr. Gibson for his interesting address was carried.

The meeting then adjourned.

G. M. STEWART,
Secretary.

REPORT OF THE MICROSCOPICAL SECTION.

A meeting for the organization of the Section was held on November 4th, 1899, and the following officers were elected for the ensuing year: W. E. Saunders, Chairman; S. B. McCready, Secretary; J. A. Balkwill, J. Dearness and J. H. Bowman, Committee.

During the season eleven meetings were held, with an average attendance of seven, besides occasional visitors. At each meeting interesting subjects were discussed and the objects referred to examined under the microscope; five papers were read, viz.:

The Protoplasmic Cell—J. H. Bowman.

The Multiplication of Cells—J. Dearness.

The Protoplasmic Cell—J. Dearness.

Micrometry—J. H. Bowman.

The Natural History of Florida—W. E. Saunders,

One meeting was given over to the examination of freshly collected living organisms, two to the examination of exceedingly beautiful chemical crystals, prepared on the spot by Mr. Bowman, and one to the discussion of fermentation.

At the fourth meeting Mr. Thos. Beall, of Lindsay, brought before the members the desirability of forming a Horticultural Society in London. The project was highly approved of and energetically taken up, resulting in the formation of the very successful and enterprising London Horticultural Society.

W. E. SAUNDERS,
Chairman.

REPORT OF THE ORNITHOLOGICAL SECTION.

The reorganization meeting of the Ornithological Section of the Entomological Society was held on January 13th, 1900. Officers were elected and an outline of plans was made for the season. Monthly meetings were adopted, omitting July and August. This programme has been strictly adhered to. Nine meetings have been held, at which the average attendance has been five, and ten papers have been read, entitled as follows:

"New Birds for Middlesex and Ontario," W. E. Saunders; enumerating six species new to Ontario and eight species new to Middlesex County, all taken since the last meeting in 1894.

"An Ornithological Incursion into Florida," W. E. Saunders.

"The Sparrows of Ontario," J. E. Keays; enumerating the generic and specific peculiarities of each species, with notes on their habits, fully illustrated by specimens.

"The Cubic Contents of the Eggs of the Common Buteos," J. E. Keays.

"The Nesting of the Sharp Shinned Hawk," H. Gould.

"The Flycatchers of Ontario," W. E. Saunders.

"The Grebes and Loons of Ontario," W. E. Saunders.

"A Trip to Point Pelee," H. Gould; illustrated by specimens.

"A New Song for a Common Bird," W. E. Saunders.

"Seasonable Changes in the Food of Sparrows," J. E. Keays.

Two of the above-named papers have been published and others will be in the near future. Besides these, short notes on interesting subjects have been presented, one recording the capture of two specimens of the Long-tailed Jaeger, at Rondeau,—the first for Ontario.

The spring arrivals have also been closely recorded, 144 species being noted by members up to May 26th. Dates of the fall migrations are also being prepared and are now about complete.

A number of fine sets of eggs have been taken by the members, the best of which were six sets of the Sharp Shinned Hawk, and five sets of the Cerulean Warbler. An account of the work done on this bird was published in *The Auk* for October.

Bird protection in London was also taken up, and notices published in the papers that wanton destroyers of our native birds in the parks would be prosecuted, which notice accomplished the cessation of some shooting which had previously been going on.

All the choice new material taken by the members has been exhibited by them at the meetings, which have been interesting and enthusiastic.

J. E. KEAYS,
Chairman.
W. E. SAUNDERS,
Secretary.

REPORT OF THE GEOLOGICAL SECTION.

The Geological Section of the Entomological Society of Ontario begs leave to present its annual report as follows.

The section with Dr. Wolverton as chairman continued its meetings weekly as usual, with but a short holiday, throughout the year. The interest in Geological study

was well maintained. The Huronian rocks with many of their characteristic minerals formed the principal study, while local fossils and minerals of the Devonian period received due attention. Visits for the purpose of securing specimens were made to interesting localities in Ontario and Michigan, by members of the Section, and our table was frequently well supplied with the essentials of this department of Nature Study.

The Society mourns the loss of one of its charter members, Mr. Thos. Green, who passed away at the ripe age of eighty-seven years. His brother, who is over eighty years of age, is still a member of our Section. Until a short time before his death, Mr. Thos. Green was an energetic student of Nature, and materially added to the profit of our meetings.

The Chairman reported as follows: "I have made a special trip to Manitoulin Island and the Georgian Bay District for the purpose of obtaining characteristic fossils and minerals of these regions, as a basis for the study of the Huronian formation during the winter. I travelled in all by water 450 miles, and secured a great variety of vein matter consisting of quartz, mica, plumbago, feldspar, molybdenite, bornite and other copper ores, as well as many specimens of corals.

Manitoulin Island abounds in fossil coral, and good specimens were obtained, as you may see from the collection before you. We will make a detailed study of these during the ensuing year."

Our Chairman and Mayor Rumball of this city, also visited a farm in West Nissouri township to inspect the remains of what was one of Earth's most mighty creatures. During the Western Fair this year there were exhibited about thirty bones of gigantic size supposed to be those of a Mastodon or some closely related species of that class. Owing to the absence of teeth and most of the bones of the head, it has not been identified so far. These bones were uncovered recently by some men while excavating a drain through a peat bed, and are in a good state of preservation. The tusk measures more than nine feet in length. It is curved like a cow's horn and tapers to a point. The corrugations on the tusk where it entered the head are easily discernible. The femur is three feet in length and where it entered the socket, it is three feet in circumference. The tibia and fibula are well preserved and the foot bones are entire. Four ribs of large size are made to articulate with the vertebræ by ball and socket joints, attesting the great antiquity of the fossil.

From the position in which the bones were found, it would appear, that the giant becoming mired in the bog fell over and lodged probably against some partially submerged log and strangled. From a careful inspection of the locality where the bones were found our Chairman thinks other parts of the skeleton may yet be discovered, as no thorough search has yet been made. It is hoped by many citizens, as well as by the members of our Section, that London may be the final resting place of these interesting remains.

Efforts are now being made to establish a public museum in the city in connection with the Free Library. The question has been mooted in the press, and was thoroughly discussed at a meeting of the Library Board, and there is reason to hope that this treasure will not be allowed to leave our district.

In connection with the museum, Dr. Wolverton and other citizens have offered to loan valuable collections for a term of years and as only a small expense would have to be incurred in fitting up the rooms in the library building, there would appear no sufficient reason why we should not have this important means of education secured to us.

Our correspondent, Rev. Dr. Philp, of Petrolea, sent us two very interesting accounts of trips he made to points in Lambton County. The first was to a point near Shetland on the Sydenham about eight miles north of Bothwell, to inspect the shale beds which he found exposed there for some distance along the river bed. They belong to the Portage Chemung group. The shale is very dark, almost black, bituminous and filled with nodules of iron pyrites. These shales are beautifully stratified and "we were compelled," he says, "to think of ice sawn for storage." The shale in every respect resembled that at Kettle Point. Fragments of very large concretions (Kettles) were discovered, hemispherical in shape, the tops apparently cut off by the ice when the water was about sixteen inches higher than at present. We also found in the vicinity several kettles firmly embedded in the shale, each of them five feet in diameter.

A little further north we came upon two outcrops of limestone each about seventy feet in length; one runs parallel with the river and the other at right angles. On each side of these outcrops kettles are ranged. These vary in size and shape. They are from one-half to two thirds of complete globes. Crevices in the limestone are filled with material of the same composition as the concretions. Though we searched diligently for impressions of calamites we did not succeed in finding any at this place.

At a place three miles up the Sydenham from Shetland the Lambton limestones are exposed. They are very fossiliferous and are crowded with Spirifera Mucronata.

The Rev. Jos. Philp also visited the Enniskillen gum beds and reported to us his findings, and sent a fine specimen of what he terms mineral Caoutchouc. It was obtained from lot 16, second con., Enniskillen, near Oil Springs.

The bed is situated on the surface, and is quite extensive, though much of it has been removed and used as fuel for steam raising. With a fan blast it burns well. In appearance it resembles tar. It is almost jet black, dense and solid, somewhat resembling asphalt. People select the cleaner parts and use it as chewing gum. They say it is better than it looks. It is probably of the same origin as the petroleum found in the same vicinity.

Mr. Philp also examined the bituminous shales of Alvinston which are exposed at that point for nearly a mile along the river. They belong to the Portage Chemung group. He found one impression of a Calamite, very distinct. The stratification and the cleavage are noteworthy and the nodules of iron pyrites are very beautiful. At this point there is no trace of a kettle. He thinks the kettles are found only in the lowest portion of this formation. At least that is the case at Shetland, where the older strata are exposed.

The Lake Superior Copper Mines.

Mr. Goodburne, who visited the Lake Superior copper mines in October, 1899, read a paper descriptive of that region, opening with a brief description of copper and its ores. The first record of the discovery of copper in the Keeweenaw Peninsula, Michigan, was in 1636, and from that date its history was traced down to the present day. Mining, however, dates only from 1831, when Dr. Douglass Houghton, while a member of the Schoolcraft expedition, first made known the great wealth of the peninsula, and in 1834, the government first opened up the country to mining. From a review of the history of early mining, Mr. Goodburne proceeded to a description of the principal mines, chief interest centering in the great Calumet and Hecla, which yields 100,000,000 pounds of refined copper annually from the conglomerate lode underlying 20 acres of surface, a product valued at $18,000,000, taken from under land, which originally cost $1.25 per acre, or $25.00 for the most valuable copper mine in the world.

The great Keeweenawan formation consists of a series of eruptive beds, alternating in the upper division with sandstone and conglomerates, the whole lying above the Huronian slates, schists and metamorphic rocks. The formation was, probably, originally horizontal at the bottom of the ancient sea. The system to the east is the Medina division of the Silurian formation, a time when great volcanic forces disturbed the earth; but it was probably the subsequent movements of the crust which tilted the beds so as to form a great trough or synclinal. The eastern edge is on the end of Keeweenaw Point, and the western across the Minnesota border. Michipicoten Island and the Nepigon district are on the reverse, or northern, fold of the synclinal, for while the Michigan edge dips toward the northwest, the northern edge dips in the opposite direction, but it is very much broken by depressions, and not so easily traced as the southern edge. The lower beds of the Keeweenawan formation consist mainly of a series of coarse crystalline gabbros, from 20 to 50 feet thick. There are 4,000 or 5,000 feet of these lava flows, after which the eruptions became somewhat different in chemical character, and more frequent, with thinner flows. These flows contain the copper. The lava is generally basic, like basalt, but acid and intermediate types are present. Among the typical kinds may be mentioned gabbro, diabase and melaphyr, including the amygdaloidal examples of the two latter, in which is the copper. Other rocks are the acid lavas, including felsites and porphyries, which have furnished much of the detritus for the sandstones and conglomerates, and these acid lavas, which do not flow as far or so freely as the basic, quite often trend across the other rocks in the form of dikes or bosses, with dome-like summits.

The copper occurs in the trap formation, which cuts the centre of the peninsula, and continues its course southward through Ontonagon county, extending westward through Wisconsin, to the western shore of Lake Superior, thence northward to Isle Royal, where it disappears on the mainland, appearing again in the Nepigon district. In all these places the geological characteristics are the same, thin sections of rock from one district being scarce distinguishable from a specimen taken from another. Eastward, the copper is found on Michipicoten Island, and the formation is traceable at Gros Cap, a few miles from Sault Ste. Marie.

The copper is not an ore, but is the virgin metal, all the paying mines being opened on lodes which carry native copper. There are a few fissure veins in Keeweenaw County (on the north of the peninsula), which carry grey sulphurets producing as high as 25 per cent. refined copper. All the mines produce considerable amounts of native silver, and the Quincy Company reduces its mineral by electrolysis in order to save the silver, which averages 38 ounces to the ton of copper.

When the lava flows rested under the ancient sea, the interstices in the frothy portion were filled with copper by electro-chemical action, forming the amygdaloidal rocks. The conglomerates are ancient sea beds, formed of boulders, sand and gravel, broken from the surrounding rocks of the ancient sea. These also had interstices, and were filled with copper in the same manner.

That the copper was carried in solution and arrested in its present position by some precipitating agent is conceded by most authorities; and that it was intimately associated with the melaphyrs that have had their ferrous iron changed into a ferric state by taking up more oxygen, has given rise to the now widely accepted theory that in the peroxydation of the ferrous iron is to be found the agent of precipitation. The origin of the copper is not so easily explained. One theory is that the copper was brought to the surface by the lava flows; another that it was deposited in a sulphuretted form, along with the detrital rocks of the period.

Mr. Goodburne illustrated his paper with diagrams of the district, showing the synclinal, and the position of the mines; and exhibited many beautiful specimens of copper and silver, from the form in which it was mined, until the copper was gathered from the great stamp mills.

We offer a suggestion to the other sections of our Entomological Society.

As it is difficult to secure members to replace those lost owing to removals, deaths and other causes, we would suggest occasional public meetings under the auspices of the parent society at which there should be a programme of addresses on subjects relating to nature study illustrated where practicable by views. These public meetings would advertise our society and would tend to increase both the interest and profit of the meetings.

G. KIRK,
Sec. *pro tem.*

REPORT FROM THE ENTOMOLOGICAL SOCIETY OF ONTARIO TO THE ROYAL SOCIETY OF CANADA,

Through the Rev. C. J. S. Bethune, D.C.L, Delegate.

During the year that has gone by since our last report to the Royal Society, the Entomological Society of Ontario has pursued the even tenor of its way and continued its useful and scientific work. There are no striking events to record, but much has been done of permanent value and additions have been made to the general store of the knowledge of insects and their ways.

The thirty-sixth annual meeting of the Society was held in October last at its headquarters in London and was especially noteworthy for the conference that was held on the important subject of the San José scale. Those who took the principal part in it were Prof. James, Deputy Minister of Agriculture for Ontario; Dr. Fletcher, Entomologist and Botanist of the Experimental Farms of the Dominion; Mr. J. Dearness, one of the special commissioners appointed by the Ontario Government to investigate the

ravages of the scale in this Province; Mr. G. E. Fisher, Official Inspector; Professor Lochhead of the Ontario Agricultural College at Guelph, and Professor Webster of the Ohio State Agricultural Experiment Station. The proceedings at the Conference are published in full in the 30th Annual Report of the Society, which was presented to the Legislature of Ontario at the opening of its last session.

The Report also contains a number of valuable and interesting papers and is illustrated with sixty-six wood-cuts, many of them drawn specially for the purpose, a portrait of Mr. Henry H. Lyman, the retiring President, and a plate representing the structure of a butterfly's wing. Among the papers may be mentioned the following: "The President's Annual Address," by Mr. Henry H. Lyman, Montreal, in which the formation of an entomological union for the authoritative settlement of questions of nomenclature especially, was strongly advocated; an account was given of the importance of accurate descriptions of larvæ and the difficulties to be surmounted in making them; a short review was made of the principal work of the year in both economic and systematic entomology, and some account of recent publications was given. "One Hundred Years of American Entomology," "The Native Home of the San José Scale," and "Some Notes on the Larval Habits of the Gray Hair-Streak Butterfly," by Prof. F. M. Webster. "Notes on some Insects on Coniferous Shade Trees," "Injurious Insects of the Orchard, Garden and Farm in 1899," "Nature Study Lessons on the Cabbage Butterfly," by Prof. W. Lochhead, Guelph. "Spiders," by the Rev. Dr. Fyles, South Quebec. "The Wing Structure of a Butterfly," and "Remarks upon some Cuban Insects," by Mr. J. Alston Moffat, London. "Fatal Bite of an Insect," and "Some Observations of a Bumble bees' Nest," by Rev. Dr. Bethune, London. "Injurious Insects in Ontario During 1899," by Dr. Fletcher, Ottawa. "The Electric Light as an Attraction to Moths," by Mr. A. Gibson, Ottawa. "Asparagus Beetles," by Mr. W. N. Hutt, Southend.

The volume contains the reports on the work of the preceding year by the different officers of the Society, the Geological and Microscopical Sections at London, and the flourishing branches in Montreal, Quebec and Toronto. There are also valuable "Notes on the Insects of the Year," by the Directors, Messrs. Harrington, Evans and Gibson, in their respective territorial divisions, and by Messrs. Moffatt, Bethune and Fyles on the season of 1899.

The report concludes with an account of the first annual meeting held at Lacombe, Alberta, in November last, of the new and vigorous North-West (Canada) Entomological Society, which is fortunate in having Mr. Percy B. Gregson, of Waghorn, as its energetic President. The report of its council, the President's address, and papers by Dr. Bethune on "The use of Entomology;" Dr. Henry George on "The Pocket Gopher," and an address by Mr. Henry H. Lyman, are published in full.

The librarian states that the library of the Society now contains 1,627 bound volumes, besides a large number of pamphlets and periodicals. The chief additions to the cabinets of insects have come from Manitoba and Cuba.

Four distinguished entomologists were elected honorary members of the Society, viz: Dr. L. O. Howard, United States Entomologist, Washington, D. C.; Professor John B. Smith, Sc.D., Rutgers College, New Brunswick, N. J.; Professor F. M. Webster, Wooster, Ohio; and Professor H. F. Wickham, M.A., Iowa City, Iowa.

The Society has continued to publish its monthly magazine, "The Canadian Entomologist," which was begun in 1868, and of which the thirty-second volume is now being issued. The thirty-first volume was completed in December last and consisted of 380 pages illustrated with six photo-gravure plates and thirty-six wood-cuts; thirty new genera of insects are described and ninety-two new species. The contributors number sixty, of whom sixteen are residents in various parts of the Dominion, thirty-nine in the United States, and one each in England, Germany, Finland, Brazil and Japan. Among the large number of important papers may be mentioned the descriptions of Coccidæ from both North and South America by Professors Cockerell and Tinsley, and Messrs. Ehrhorn, Parrott, King, Hempel (Brazil) and Marlatt.

Papers on Classification: The Entomophilous Wasps by W. H. Ashmead; Dragon Flies by Jas. G. Needham; North American Myrmelionidæ by N. Banks; Coccidæ by Prof. T. D. A. Cockerell; Bees by Chas. Robertson; Wasps by S. N. Dunning; descriptions of new species: Lepidoptera by Prof. J. B. Smith, Dr. H. Skinner and Dr. H. G. Dyar; Orthoptera by Dr. Samuel H. Scudder and Jerome McNeill; Hymenoptera by

Carroll Fowler and W. H. Harrington; Diptera by D. W. Coquillett; Neuroptera by Rolla Currie; and Hemiptera by A. L. Quaintance and Otto Heidemann.

A list of Manitoba Moths by A. W. Hanham; the Coleoptera of Canada by H. F. Wickham; Ontario Acrididæ by E. M. Walker; Canadian Lepidoptera by J. A. Moffat, T. W. Fyles and E. F. Heath.

Papers of an Economic character by Enzio Reuter (Finland), M. Matsumura (Japan), F. M. Webster, R. H. Pettit, W. Lochhead, E. A. Carew-Gibson, and others.

From the foregoing list, which does not include short notes, book notices and other items of interest, it will be seen that the magazine covers the whole field of systematic entomology and contains articles of importance by well-known authorities on most of the orders of insects. It has become so necessary to the working Entomologist that there is a constant demand for complete sets of the volumes from the beginning and the Society has in consequence been obliged to reprint several of the earlier numbers.

SAN JOSÉ SCALE DISCUSSION.

At the request of the President, Mr. G. E. Fisher, of Freeman, Ont., the Provincial San José Scale Inspector, stated that he was present by direction of the Ontario Department of Agriculture, and was willing to give any information at his disposal with regard to the prevalence of the San José scale in the Province, and the work which had been done during the past season. He regretted to say that the state of affairs was not as favourable as he could wish, and that the scale was now known to be present in many districts where it had not been discovered last year. Many experiments had been tried by instruction of the Department to see if a practical remedy could be discovered to control the insect instead of the drastic measure of cutting down the trees. He was glad of the opportunity to let the members of the Entomological Society know what the general trend of his experiments had been. To begin with he would make the statement that the infestation of Ontario orchards by the San José scale was a far more serious matter than fruit growers of the Province yet realized.

The following is a condensed summary of Mr. Fisher's address:

A great deal was said at the last annual meeting of the Society about the value of whale-oil soap as the best remedy for the San José scale, and particular mention was made of the satisfactory condition of orchards now standing on Catawba Island, which had formerly been badly infested by the scale. I therefore took great pains during the past summer and carried out many careful experiments with this material, using the strength recommended as the best, namely, 2 lbs. of whale-oil soap to one gallon of warm water, as well as other quantities. When a tree was known to be infested it was treated thoroughly with 2 lbs. to the gallon, and all trees in the immediate neighbourhood were also sprayed with a solution of $1\frac{1}{2}$ lbs. to the gallon. On other trees kerosene emulsion or crude petroleum were used, and careful notes taken of their effects upon the tree and the scale. With regard to the soap, the results were rather disappointing. In no case was the scale entirely eradicated, even when the soap was applied with the greatest care, according to the formula. Some trees where the full strength of 2 lbs. to the gallon was used are still infested, and the infestation is of about the same extent as at the beginning of the season. The scale was certainly reduced on cherry trees, and it was noticed that the soap had an excellent effect in clearing these trees of aphids. The treatment was applied just at the time the buds were bursting, when most people would think it was too late to use it without doing injury to the trees, but I found that no harm was done even when many of the blossoms were open. As a rule there is too much blossom on trees, and if some of this is destroyed it is an actual advantage, therefore this late spraying may be very beneficial. We have noticed that the young scales will move out on to a part of the tree which had been sprayed in the spring with the soap mixture, and will settle there and multiply. On the 18th August last I made an application, at Niagara, on a very badly infested tree, one, in fact, which was entirely covered by a moving mass of young crawling scale insects, walking all over the tree trying to find a place to settle. The soap was applied to the tree with a whitewash brush, with the object of finding out how reliable the soap was, and a little later a second application was made. I examined the tree again about the middle of November, and I think I had the nicest example of

the multiplication of the scale that could be found. The soap had killed the scale in the first place, of course, but the tree was just now in the same condition as when it was first applied, and the scales were multiplying on the part which had been washed with the soap. Below the untreated portion and for probably a foot and a half down over the part which was washed with soap, the larvæ were coming down in great numbers and there were actually mature females giving birth to young. This shews that washing with soap will not deter the scale insects from settling there and starting new colonies. In the middle of September I took my knife and scraped off the scales from a space one inch by two, clearing the bark entirely, and in two days this space was again entirely covered so that no bark could be seen. In the middle of October the same experiment was tried and the only difference was that it took twice as long for the space to be occupied again by the scales.

Kerosene also has been somewhat unsatisfactory. Trees have been killed and the scale does not seem to have been cleaned up. Crude petroleum has I think on the whole given the greatest satisfaction. Where it was applied on apple trees I have seen no bad results. I applied crude petroleum in one orchard to about 40 apple trees and 100 plum trees without in any way injuring a single tree. This was done about the middle of May. The trees were entirely freed from the scale and all that had been alive during the winter previous were cleared off. Case-bearers and many other insects were also destroyed. The material used was a mixture of 25 to 30 per cent crude petroleum with water, and applied as a spray. I am of the opinion that a mixture of half the quantity of soap recommended and half of crude oil in a combination pump would be preferable to either used alone. The crude petroleum will kill the scale insects but if applied in considerable quantities is apt to injure the peach and other tender trees. Great care should be exercised in applying it as advised. The soap alone is not a strong enough application, it does not kill enough of the scales. I do not think it would be safe to recommend crude petroleum for general use. People did not use whale oil soap in accordance with instructions given and the chances are they would not follow instructions when using crude oil, and thus trees would be killed. Judging from the experience of the past year I think some of the reported cases of injury by crude petroleum may be due to the way in which the substance has been applied. It must be borne in mind that no portion of the tree should be covered more than once by the spray or the oil will accumulate from each spraying until there is sufficient to injure the tree. I notice frequently when people are spraying that they begin on the trunk then spray the branches and when finishing bring the nozzle down again on to the trunk thus giving that part of the tree a double dose of the oil. This carelessness I think is the cause of much of the injury reported. The way that we spray is as follows: The pump is placed on an ordinary stone boat, one man sprays in one direction and one in another, and each tree is sprayed from four standpoints, or in other words as it is approached and as it is left behind in passing down the rows on each side of it. There is one part of the tree which is frequently overlooked when spraying, that is the upper side of the limbs on the opposite side of the tree to that which is being treated. This can only be reached by pushing the nozzle into the head of the tree and spraying over to the opposite side. (Mr. Fisher here passed around the meeting, specimens of infested wood, which had been cut from trees which had not been treated at all, and others from those treated with 2 lbs. of whale oil soap to the gallon or which had been sprayed with a 30 per cent mixture of crude petroleum. It was noticed that all these had some living scales on them.) In summing up the matter of remedial treatment I think the best results will follow if work is done in the month of April both with whale oil soap and petroleum applications. A perfect remedy should remain fresh for a long time, it must penetrate easily and must of course destroy the scales without injuring the tree. Soaps made entirely with potash are the best—soda makes a hard soap which solidifies on the trees. I have never seen an apple tree which was in any way injured with crude petroleum applied of the strength I have mentioned. The whale oil soap from Catawba Island has done the best work and it was only in the case where this Ohio soap had been used that the infestation did not increase. In the case of the other soaps tried the infestation has increased beyond what it was last spring. Many people did not know of the presence of the San José Scale in their orchards until they found it on the fruit. Almost the whole of the Niagara district is now infested with the scale and it is also very prevalent in the Guilds section where

little has been done to check it. The San Jose Scale has spread much during the past season and it is now abundant where it was hardly noticeable last year. It seems to me as if this scale question is going to develop into a great national calamity, and the time will come I fear when our grandchildren may have to tell their children of the good old times in Ontario when people used to be able to grow apples and other fruits.

With regard to the work of the scale it was formerly claimed that the fruit of the peach would not be injured on account of the fuzzy down upon its surface, but during the past summer I have seen peaches so covered with scales as to have the appearance of red apples, from the discoloration due to the injurious presence of the insect.——

Mr. Fisher here gave a review of the history of the San José Scale in Ontario and the excellent work that had been done by the Government in fighting it and protecting the fruit growers from loss. He was glad to find that public opinion was changing rapidly with regard to the work that was being done. He said "at Niagara, particularly, everybody is realizing that a very great danger threatens them and that something must be done or their interests will be destroyed. The fruit interests in Ontario are very great. One gentleman in St. Catharines sold $10,000 worth of peaches in 1899 and another at Niagara sold over $4,000 worth this year, and these peaches do not by any means represent their whole crop of fruit, as there are plums, cherries, pears, apples and small fruits beside. Some years of experience have taught us that when once we discover the San José Scale in an orchard no idea can be formed without close examination as to the extent of the infestation. In 1899 one orchard was examined carefully and 87 trees were marked—about the middle of this summer I visited this orchard and traversed it from one corner to the other, and I found the scale on every single tree I examined, and moreover on the very first twig I took hold of in every case. A good deal has been said about the rate at which scales can travel, and I am sure that this has been underrated. I have watched them a great many times and find that the young larvae can travel an inch in a quarter of an hour so that in a week they could travel half way across an orchard, and if blown to the ground I am quite sure they are capable of getting back again on to the tree. In addition to this there is no doubt they will crawl on to everything that moves and by that means will be carried in every direction. The increase of the scale is very rapid indeed towards the end of the season, especially during the month of September. Notwithstanding all that I have said, and remembering the state of affairs on Catawba Island, it would seem that if an orchard is treated conscientiously and regularly the scale will not exist in sufficient numbers to materially mar the crop of fruit. This is particularly true of the early varieties, which are practically developed before the season of the greatest increase of the scale. I may mention that during the past season I have noticed a very large number of the little black lady-bird beetles (Pentilia misella) which have done such good work in feeding on the scale.

Dr. Fletcher congratulated the Society on having Mr. Fisher present at the meeting. His excellent and careful work on the San José Scale was well known. He was somewhat disappointed at the results of Mr. Fisher's experiments with whale oil soap. This remedy was an extremely valuable one, he had used it a good deal and considered that a good caustic potash fish oil soap such as the Ohio soap made by Mr. Owen, was one of the very best remedies against plant lice and bark lice of all kinds, moreover the amount of potash 12% was sufficient to act as a decided fertilizer to the trees. Many have noticed the good effect of this soap upon trees where it had been used. It was also claimed by the manufacturers to be an excellent remedy against the Peach Leaf Curl and some other fungous diseases. He considered that the thanks of the Society were due to the Honorable Minister of Agriculture for instructing Mr. Fisher to attend the meeting and to Mr. Fisher himself for the valuable and practical address he had given. Everybody who heard Mr. Fisher knew that he himself believed every word he stated, and that every experiment he recorded had actually been carried out by himself.

Prof. Webster, of Wooster, Ohio, spoke in complimentary terms of Mr. Fisher's address and said that his information was so valuable because he told us what he had seen with his own eyes, not what he had learned from others. He himself was afraid to recommend crude petroleum for general use as he had known of several instances of injury to trees, but doubtless many successful experiments had been put on record.

A general conversation then took place on the subject of the San José Scale, and all united in the belief that the attack upon our fruit-trees is a most serious one and that

the owners of orchards in the infested districts should be warned of their danger and urged to take prompt and effective measures for the repression of the pest. A hearty vote of thanks was given to Mr. Fisher for coming to the meeting and affording so much useful information.

EVENING MEETING, WEDNESDAY, NOV. 14TH.

The meeting was called to order by the President, the Rev. Dr. Fyles, who spoke of the successful gathering the night before when we joined with the London Horticultural Society in a most popular and most interesting meeting. It was quite proper he thought that the consideration of Horticultural topics should take precedence of Entomological, for Adam tilled the garden of Eden before the animals were brought before him to be named. He then gave some amusing instances of the tremendously long names that some of Adam's entomological descendants had been inflicting upon innocent species of insects.

ANNUAL ADDRESS OF THE PRESIDENT.

By the Rev. T. W. Fyles, D. C. L., F. L. S., South Quebec.

At our annual meetings, Injurious Insects—their ravages and how to check them, have very properly received a great deal of attention. In a population such as ours, largely engaged in agricultural, horticultural and fruit-growing pursuits, such subjects are of never failing interest; and our economic entomologists when they treat of them are very sure to receive attention. To-night I venture to direct your thoughts to a different phase of insect life, and to operations that are beneficial to vegetation; and I trust that we shall spend a short time pleasantly in the consideration of our insect friends, and the offices they serve for promoting the fecundity and improvement of plants.

Dr. Gray did so much to bring the science of Botany into popularity on this continent, and in Canada our excellent public schools have so effectively taken the subject into the *curriculum* of school-work, that now, when addressing an audience upon the instrumentality of insects for the fertilization of blossoms, it is hardly necessary to dwell upon the various re-productive plant-organs. A few brief statements to put you in remembrance of these will be sufficient on this occasion.

You know then that in the blossoms of a large proportion of plants there are, in the centre of each blossom, first, at the base, the *carpels*, and upon them the *styles* surmounted by the *stigmas*—these are the female organs. Around them are, secondly, the *stamens* or male organs each consisting of a filament bearing an anther containing pollen-grains. When these grains are ripe the anther bursts, and the pollen is scattered by various agencies.

For the fertilization of the blossoms it is necessary that some of the pollen-grains should alight upon the stigmas of the female organs. So alighting they adhere, because of a glutinous exudation from the stigmas; and, in a short time, there descends from each of them a sort of radicle, or very fine tube, which works its way down the style, and through, or between, the integuments, till it enters the micropyle and mingles its juices with those of the ovule. The work of fertilization is then complete, and the ovule produces a seed, which in due time and under favourable circumstances will produce a plant like unto that from which it sprang.

The blossoms of the wild rose, the apple, and the cherry are familiar instances of these bisexual flowers.

In many other kinds of plants there are both male and female blossoms—*staminate* blossoms and *carpellate* blossoms—growing on the same plant. Call to mind a field of Indian corn (*Zea mays*), well planted, well cultivated, and in full bloom. Such a field is a sight to gladden the owner's heart, and to excite the admiration of every thoughtful beholder. The tall plants tower over head, each surmounted by the graceful panicle of male blossoms, the anthers of which dangle like bells from the sloping roof of a Chinese pagoda, and scatter the dust of pollen at every puff of air or other disturbance. Be ow bursting from their leafy wrappers are the stigmas of the carpellary blossoms spreadin

like tassels of pale green silk to catch the pollen that descends. No bees meddle with these anemophilous blossoms; and it will be observed that they possess none of those things which attract insects, viz, bright colours, nectar and perfume.

Usually the seeds of pumpkin (*Cucurbita pepo*) are sown here and there among the corn, and the plants from them trail far upon the ground. The flowers of the pumpkin also are of two kinds, male and female, growing upon the same plant; but it is evident from the nature and position of the plants that the wind cannot effect pollination in their case: the agency of insects is necessary; and the blossoms are large and showy, and well designed to attract the bee.

Again in numerous instances the male blossoms grow upon one plant, and the females upon another of the same kind. Every grower of hops knows that for successful cultivation he must have male plants intermingled with the female. The proportion is, if I remember rightly, one in ten, or one in twelve.

The willow and the poplar are familar examples of plants of the kind we are speaking of. Who has not rejoiced to see, in the early spring, the golden catkins of the male willows, for they are tokens that "the summer is now nigh at hand?"

The country people in the south of England call the flower-laden branches of the willow "palms," for the blossoms come about Palm Sunday; and in olden times branches laden with them were carried to the churches, to represent the palms carried before our Lord on his triumphal entry into Jerusalem. In this word *palms* so applied we have a local popular name that would puzzle any to whom the circumstances of its application were unknown. And, with reference to this, if I may digress for a moment, I wish to point out that Mrs. William Starr Dana in that bright and useful little work entitled "How to know the Wild Flowers" has made a curious mistake for want of a little old-country "folk-lore." On page 124 she takes pains to shew that the word Marigold comes from "the Anglo-Saxon *mere* a marsh" and that the whole name may signify *marsh-gold*. Which (she says) "would be an appropriate and poetic title for this shining flower of the marshes," (p. 124). But Marigold simply means Mary-gold—the flowers of *Caltha palustris* having been used by our forefathers to garnish the churches on Lady Day (March 25th), just as the Pasque Flower was used at Easter, and the Michaelmas Daisy on the Feast of St. Michael and All Angels (Sept. 29th).

> "The Michaelmas Daisie among dede weeds,
> Blooms for St. Michael's valorous deeds,
> And seems the last of flowers that stood
> Till the feste of St. Simon and St. Jude"—

says an Old English Kalendar. But to return—

The willow-blooms are pollinated by means of insects. Small bees of the genera Andrena, Osmia, etc., as well as the honey-bee, frequent them in the day time, to obtain bee-bread for their young and nectar for their own delectation; and in the dusk of the evening hibernated noctuids resort to them for refreshment.

It is a common thing for European Entomologists to spread a sheet under the willow boughs at night, and then by a sudden jar upon the limbs to bring down a shower of moths. The drowsy insects lie inert whilst the operator with the aid of a lantern selects from them such as he fancies.

All these insects fly from flower to flower and from tree to tree and convey the pollen from the male to the female blossoms.

The poplars also are of two sorts, male and female—the staminate flowers growing on one and the carpellary flowers on the other. But in this case the blossoms are of unattractive colouring. They have no nectaries; and the pollen is light and dry. The wind is the agent of pollination in this case.

We have glanced then at three kinds of blossoms:—

Perfect—in which stamens and carpels grow in the same flower.

Monœcious—distinct male and female blossoms growing on the individual plant.

Dicœcious—one plant producing male blossoms only, and another only females.

We have also noticed two means of pollination—(1) the agency of insects; (2) the agency of the wind. In some kinds of bisexual blossoms self-pollination takes place, as in the Mallow; but with these we have not now to do. Our attention is to be given to the insect-pollinated flowers.

Of the importance of cross-pollination—*i. e.* of fertilization with pollen from other blooms of the same sort, we may judge from the arrangements made in nature to secure it.

(1) First we notice the wonderful abundance of the pollen—sufficient for every requirement. Take your stand by an apiary towards evening, and watch the returning bees. How laden they are with bee-bread—which is compressed pollen—and yet in the course of their operations they have been instrumental in fertilizing thousands of blossoms. Yes, the busy workers have discharged their duties, and have not been stinted in their reward.

(2) We find that the various arrangements of the floral leaves, or perianth, for the shelter and preservation of the pollen are worthy of observation. Take that common flower the Dandelion (*Taraxacum officinale*). This flower is in reality an inflorescense consisting of a hundred or more flowerets packed together. This collection of small blossoms is surrounded by a green involucre—the whole forming a capitulum which closes tight on the approach of rain.

In the Sun-flower (*Helianthus annuus*), the capitulum bends over in wet weather; and the moisture is shed from the roof-shaped receptacle and the sheltering disk flowers.

In many of the lilies, the corolla forms a bell-shaped roof under which the re-productive organs lie in safety; and in the snap-dragon and other flowers of like structure they are shut up as in a cabinet—a cabinet which the bees know how to open.

(3) We learn that the relative positions of the various organs in many instances render self-pollination impossible.

The English Primrose (*Primula vulgaris*) affords us an instance of this. The flowers of the primrose are of two kinds. In one the style rises higher than the stamens, in the other the stamens are placed above the style. In either case the stigmas are at the same height as the anthers in the other. An insect comes to a flower which has a long style; its proboscis at a certain part is charged with pollen from the elevated anthers of a blossom which it has just left. As the insect rifles the long-styled flower of its sweets this pollen is brought in contact with the stigma which is at the right height to receive it. At the same time the proboscis of the insect is acquiring a fresh supply of pollen lower down from the short anthers and this it will convey to the next short-styled primrose blossom that it visits. It is *possible* that the short-styled flower may be self-pollinated; but it is quite impossible that the long-styled flower can be so.

(4) We see that the ripening at different times of the anthers and stigmas of some kinds of blossoms insures, with the aid of insects, the cross-fertilization of blossoms.

The Monk's-hood (*Aconitum napellus*) affords us an example of this. The blue flower of the monk's-hood is really the calyx. Its uppermost sepal forms a sheltering hood in which the two posterior petals are hidden. These petals are of a remarkable shape, curved and clawed, and they secrete nectar which attracts the humble-bees. The monk's-hood is exclusively a humble-bee flower. The other petals are either wanting or are insignificant. In a newly opened monk's-hood flower the numerous stamens protrude and their anthers ripen before the stigmas. A humble-bee alights in the middle of the flower, holding on by the side sepals. In its struggles to reach the nectaries, the under part of its body is brought in contact with the anthers and becomes charged with pollen.

In the older blossoms of the monk's-hood the stamens all bend back out of the way, and the carpels are protruded. A bee alighting on such a blossom brings pollen to the stigmas now ready to receive it and the blossom is fertilized.

Another noteworthy instance of a plant which ripens its anthers and stigmas at different times is afforded by the Foxglove (*Digitalis purpurea*). The foxglove like the monk's-hood is a humble-bee flower. Indeed its form and size seem especially adapted for the reception of the humble-bee. The stamens and pistil are extended along the upper part of its inner surface. A humble-bee backing out, after sucking the nectar from the further recesses of the flower, scrapes off, by means of its bristly coat, the pollen from the anthers, and carries it on its back to other foxglove blossoms whose stigmas are ready to receive it.

The result of cross-fertilization seems to be the production of more numerous and finer seed, and eventually of stronger and more beautiful plants.

Some flowers have a wide circle of insect attendants. The Buttercup is known to be visited by more than sixty different kinds of insects (Percy Groom's *Elementary Botany*, page 121). Others are exclusive, permitting only the visits of a favoured few.

We have seen that the willow catkins are pollinated by bees and noctuids. The flowers of the Blueberry (*Vaccinium Canadense*) are fertilized by wasps which resort to them in great numbers. The round head and short lingula of the wasp fit well into the shallow saucer-like blossom.

Another plant that is visited by wasps is the Kalmia (*Kalmia angustifolia*). This also has shallow blossoms which have this peculiarity, each stamen is sunk in a groove the shoulder of which confines the anther. When an insect in search of nectar butts against the centre of the flower the stamens with their anthers are set free and start forward, scattering pollen on the front of the intruder. This pollen is carried by the insect to other blossoms of the sort and fertilizes them.

In early summer the Lilac blooms are visited by long-tongued moths, such as *Amphion nessus* Cram., *Hemaris thysbe* Fabr., etc., which fly in the daytime. In the dusk of the evening the white-blossomed perennial Phlox invites the larger hawk-moths, *Sphinx chersis* Hubn., *S. Kalmiæ* A. & S, *Deilephila chamænerii* Har., etc. The flowers of the Dogbane (*Apocynum androsæmifolium*) are favourites of moths of the genera Plusia and Thyatira.

Of the butterflies *Argynnis myrina* Cram. has a partiality for Golden Rod (*Solidago Canadensis*); *Pyrameis cardui* L. for Red Clover (*Trifolium pratense*); *Satyrus alope* Fabr. and *S. nephele* Kirby for the blossoms of *Asclepias cornuti*; *Pamphila Manitoba* Scud. for *Solidago lanceolata*, and so on.

In the Society's Annual Report for 1899 I gave the life-history of a small moth *Metzneria lappella* Zel. newly introduced from Europe. It is a burdock insect. Its larvæ feed on the seeds of the plant, and the moth itself feeds from and fertilizes the burdock flowers.

The flower-head of the Burdock (*Lappa major*) contains about forty flowers. They are compressed in a globular involucre, the imbricated scales of which are coriaceous and tipped with awl-shaped hooks. The calyx in each flower is represented by a dense circlet of delicate, white, silky and branched hairs surmounting the seed vessel. The corolla consists of a white tube half the length of the blossom, and then of a vase-shaped, purple expansion, five-cleft at the top. The brownish purple anthers are united and form a tube which produces pollen on the inner side. Through this tube when dehiscence occurs the pinkish white style forces it way, carrying with it the delicate, white, pellucid pollen-grains. The style then parts at the top into two branches which bear the stigmas on the upper surface. An insect carrying pollen-grains from other flower-heads intrudes among the flowerets and leaves pollen-grains attached to the stigmas. In its efforts to reach the nectaries of the flower it dislodges pollen from the freshly protruding styles and then bears it away to fertilize other blossoms.

The Evening Primrose (*Œnothera biennis*) is the special plant of *Alaria florida* Gn. The moth fertilizes the blossoms and is sometimes wrapped in the closing petals on the approach of day. Its larvæ feed upon the plant.

The honey-bee fertilizes the white clover and the humble-bee the red. Grant Allen in "Flash Lights of Nature" has drawn attention to the fact that as the flowerets in a head of clover are fertilized they droop over out of the way so that the bees may not be hindered in their work by vain endeavours.

Another flower that is pollinated by bees is the Nasturtium (*Tropæolum majus*). Three of its five showy petals at a certain distance within are set with a protective fringe, a veritable *chevaux-de-frize* to keep out small insects which would rob the flowers of its sweets and accomplish no good purpose. When a bee of sufficient weight enters, it bears down this fringe over the anthers, and at the same time comes in contact with the advanced style, the stigmas of which become charged with pollen which the bee has brought from other nasturtium blooms. The bee passes into the recesses of the flower, to imbibe the nectar accumulated in the spur, and as it does so the fringe and the stamens rise to their normal position. Having exhausted the supply of nectar, the bee backs and turns to make good its escape, and in its efforts to do so is covered with fresh pollen from the anthers of the flower.

The Campanula grown in our gardens (*C. medium*) has an interesting lesson for us. The long flower-bud, yet unopened, encloses the tall pistil, along which the five filaments with their long anthers are extended. When the anthers dehisce the pollen masses adhere to the style leaving about a quarter of an inch at the top free. This projecting

part contains the five stigmas. As soon as the corolla opens the anthers shrink away from the style and shrivel up, leaving the pollen masses behind them. At the same time the five sections of the style part, and curl up ram's horn fashion.

Now comes the bee as the minister of Hymen. In this case it is *Megachile scorbicularis* Smith. The insect comes with its abdomen thickly coated on the under side with pollen from other blossoms. As it passes into the flower to get to the nectaries below some grains of the pollen with which it is already charged are scraped off by the curled stigmas and adhere to them. The bee secures a further supply of pollen; but as it passes out of the blossom the under surfaces of the parted style take nothing from its fresh burden. Successive visitors completely clear away the pollen from the pistil.

The small pale flowers in the umbels of the Wild Carrot *(Daucus carota)*, the Water Hemlock (*Cicuta maculata*), the Cow Parsnip (*Heracleum lanatum*) etc., are resorted to and fertilized by a very host of small flies and ichneumons.

The English Arum (*Arum maculatum*) also is fertilized by flies. The whole process of its pollination is described in that admirable work, Percy Groom's "Elementary Botany," published by Bell & Sons, London—a work which I can strongly recommend. The story is most interesting. The flies, covered with pollen from another arum, are drawn to the newly opened spathe by an ill odour which it gives out. They creep down the inside of the spathe through a palisade of fibres which grows from the floral axis and closes in a lower chamber—a veritable fly-trap. In this chamber around the floral axis grow, at the base, a number of sessile ovaries with sessile stigmas; above them is a zone of sessile anthers. The imprisoned flies fertilize the ovaries with the pollen they have brought in, living the while upon nectar given out by the stigmas. Then the anthers above them ripen, and they become dusted with new pollen. When this is done, the enclosing fibres wither, and the flies escape to be again attracted by unpollinated arums.

The Skunk Cabbage (*Symplocarpus fœtidus*) and the Carrion Flower (*Smilax herbacea*) are mal-odorous Canadian plants that are fertilized by the aid of flies. Thoreau compared the smell of the latter to that of "a dead rat in a wall." Happily such plants are few in number and grow in out-of-the way places, or retain their offensive odors but a short time. They should serve to make us thankful—they tell us what might have been if God had not adapted the earth so favourably to the requirements and tastes of the children of men. In His great goodness He has filled it with beautiful forms and exquisite colours and harmonious voices and rich perfumes.

Asa Gray in his excellent little school-book entitled "How Plants Grow," has given reverent expression to some great truths. On page 96 he says:—

"Such a system" (The Natural System) "is not a mere convenience for ascertaining the name of a plant, but is an illustration, as far as may be, of the *plan of the Creator* in the vegetable kingdom. And the Botanist sees as much to admire and as plain evidences of design, in the various relations of the plants to each other (i.e. in their resemblances and their differences), as he does in the adaptation of one part of a plant to another, and in the various forms under which any one organ may appear. The different kinds of plants are parts of a great whole, like the members of a body or the pieces of an harmonious but complete edifice or structure; and this whole is the *Vegetable Kingdom.*"

Yes! And when the student considers the bearing of the insect tribes upon this Kingdom, he finds yet further evidences of design, he sees yet more to admire, for he obtains a wider view of the plan of the all-wise and beneficent Being whose hand hath made all these things.

> "The great Creator condescends to write
> In beams of inextinguishable light
> His names of wisdom, goodness, power and love,
> On all that blooms below, or shines above;
> To catch the wandering notice of mankind
> And teach the world if not perversely blind
> His gracious attributes, and prove the share
> His offspring hold in His paternal care."
>
> COWPER, "*Hope.*"

The Rev. Dr. Bethune moved a vote of thanks to the President for his valuable and interesting address which had afforded much pleasure and instruction to all present. Mr. Dearness, in seconding the motion, drew attention to the fact that the beautiful diagrams

exhibited in illustration of the address were drawn by Dr. Fyles himself, who thus shewed that he was no mean artist, as well as an eminent entomologist and botanist. He then spoke of the method of fertilization of nasturtiums, and said that he had formed a different theory from that put forth by the President, and would now look forward to further investigations of the case. Mr. Bowman heartily supported the motion, and took occasion to speak of the danger many people incurred from their ignorance of the distinctive characteristics of poisonous fungi, mentioning the case of one that he had gathered this autumn, the immature specimens of which were destitute of the disagreeable odour belonging to the plant.

A PLEA FOR THE SYSTEMATIC AND ECONOMIC STUDY OF THE FOREST INSECTS OF ONTARIO.

By Prof. W. Lochhead, Ontario Agricultural College, Guelph.

Ontario has an immense area of forest lands composed of hemlock, spruce, tamarac, balsam and pine. According to a recent report of the Forestry division of Ontario, "Of the 142 millions of acres comprising the province, about 120 millions of acres are still owned by the crown. Out of this, nearly 22,000 square miles, or 14 million acres are under license to lumbermen." The Government has very wisely done much to preserve these valuable domains from destruction by fire, by the appointment of a large number of rangers, who patrol, as it were, the forests and put out fires which may have been carelessly started by Indians, campers, or settlers.

There is, however, a danger, perhaps as serious as that of fire, against which no precaution has been taken. I refer to the danger of insect depredations.

Ontario is falling behind many of the neighboring States of the Union with respect to the great problem of the relation of insect work to our forest domains. Much work is being done by the Federal Government at Washington, and by many of the States where extensive forests exist, in determining the conditions which increase or decrease the extent of insect ravages. Already extensive experiments have been carried out, and much valuable information has been secured. The investigations have found that the amount of damage caused by insects in the large forests is enormous; and to prove that their results are worthy of consideration the very persons who are most directly interested in the preservation of the forest timber, the great lumber and timber companies, have readily come forward and assisted the investigator by affording every facility in the forest for a thorough study, and by money contributions as well.

In Europe every trained forester is well informed with regard to forest insects and knows how to combat their attacks; but in Ontario we are content to go along in our ignorance and pay no heed to insects or their ravages, probably because our forest areas are so large.

The questions will naturally be asked: "In what way can a study of forest insects help us in the preservation of our forests?" and "How can assistance be rendered in cases of serious insect ravages?"

In answer to the first question it may be said that a knowledge of the life histories of injurious forest insects is just as essential to a proper, intelligent campaign of operations as is a knowledge of life histories in our work against the foes of the orchard and garden. Systematic work must precede intelligent economic work; we must distinguish the economic forms from the beneficial or harmless species. In many cases it may be possible to utilize the beneficial forms as allies against the injurious forms, and in a well developed plan of operations the beneficial insects should be preserved from destruction.

I maintain, then, that a systematic collection of forest insects should be made so that we may become familiar with the forms; that a series of observations be made so that the life-histories of as many as possible be obtained for our guidance in combatting the injurious forms.

In answer to the second question proposed it may be said that hopeful results have been secured for American conditions of forestry which are so very different from those obtaining in Europe. In Europe the forests are carefully guarded, and a semi-military system of protection is in vogue in most of the continental countries.

In West Virginia it has been found that there is a proper time to fell trees to prevent damage by insects. Dr. Hopkins cut different kinds of trees twice a month year after year, and he got definite results for the oak and hickory for example. The timber cut in the winter months was gradually converted into a powder, while that cut during the summer remained almost intact. These results are confirmed in the practical operations in the forests, for it has been observed that certain species of trees felled in late fall, winter, or early spring suffer more damage than those felled in July and August.

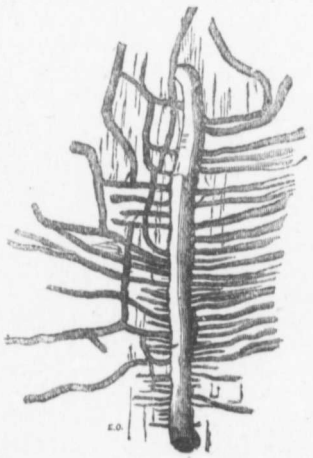


FIG. 1. Hylurgus piniperda.

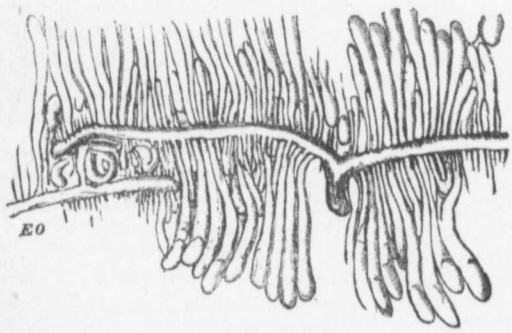


FIG. 2. Hylesinus fraxini.

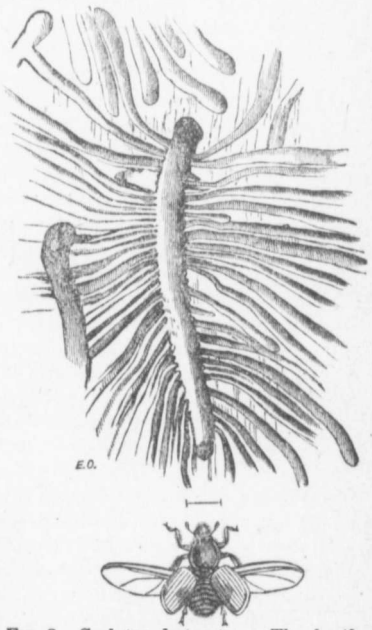


FIG. 3. Scolytus destructor. The beetle, magnified, and its burrows.
(See page 72.)

Again, much has been learnt regarding the disposal of timber which has become affected, and the influence of lumbering methods and forest fires on the general problem of insect depredations. It is a matter of observation that unhealthy, weakened, dead trees are the most likely ones to suffer from insect attacks. Thus careless methods of handling timber whereby standing trees are girdled, branches broken, and otherwise dismembered and disfigured, are very fruitful sources of insect distribution to those areas. These infested areas become centres of infestation to the surrounding forest.

In Ontario where lumbering operations are carried on in many isolated limits the danger is extremely great. The trees along the margin of the felled areas are very liable to lose their vitality on account of their inability to adapt themselves to the changed conditions which have arisen. If the lumbering operations are postponed for any length of time there is a great likelihood that the insects will spread from the felled areas to the unbroken forest, but where lumbering is carried on continuously in an area the insects find sufficient new felled timber and branches without betaking themselves to the unbroken forest.

The plan of forest-ranging for the prevention of fires is undoubtedly of tremendous value in the prevention of the spread of forest insects, but there is another work for the ranger. He could, if he knew more about insect conditions and habits, arrange for the

burning of certain felled areas at a time which would be the most favorable for the destruction of the insects which are preying upon the dead and dying trees. Such burnings, however, should be very carefully controlled so as not to injure the trees of the untouched forest, lest new feeding grounds be opened up for the insects.

Indirectly, again, the control of forest insects is of much importance. Dr. Hopkins, after a trip through the great north-west timber lands of Washington, Oregon and Idaho, states that his observations prove conclusively that forest fires originate, in very many cases, in timber areas which have been killed by insect depredators. The dead trunks and broken branches furnish suitable conditions for the rise and spread of fires.

The entrance of trunk and bark beetles into the trunk and bark of trees allows access to many timber fungi which penetrate the tissues, sap the vitality of the trees, and eventually kill them. The accompanying figures, 1, 2 and 3, illustrate the manner in which some common timber beetles burrow along the wood beneath the bark. Recent studies by European and American mycologists show very clearly how very prevalent, as well as harmful, fungous diseases are in the forests. It is quite true that insects often attack healthy trees, and fungi gain entrance to trees which have not been attacked by insects, yet the fact remains that the presence of insect pests increases very much the harmful effects of fungi.

In answer, then, to the second question asked regarding the assistance which a knowledge of insect conditions can give towards the control of forest insects, it may be said in summary that much can be done (1) by cutting and felling timber at the most advantageous season; (2) making traps for insects by girdling and felling trees to which the insects are attracted in preference to sound trees, then by careful burning of these traps; (3) preventing the cutting of timber in many parts of a limit, as these parts serve as centres of infestation; (4) preventing careless methods of handling the unfelled trees so as not to injure them and thus to expose them to insect attacks; (5) preventing fires which we know destroy many trees and render them subject to insect attacks; and (6) introducing insects which prey upon injurious forms.

We are not in a position at the present time to carry out all of these methods, for we are ignorant of the life-histories and habits of the majority of the forest insects. Accordingly, I make a plea for the better studies of insects, and such can be best accomplished by a biological survey of the great timber areas of the Province. Such a survey must naturally be undertaken by the Government, assisted, if possible, by the holders of timber limits from the Crown. It is the duty of this Society to call the attention of the Government to the necessity for such a survey.

Professor Packard states in his valuable report on the Forest Insects, published in 1890, that "the number of insects which attack the different kinds of trees in the United States is sufficiently large to excite great fears for the future prosperity of our diminished forests, unless the Government interposes, and through the proper channels fosters entomological research in this direction. Our forests, moreover, are much richer in species of trees than those of Europe. We have, without doubt, on the trees corresponding to those of Europe as many destructive species as in Europe. But we have many more shade trees and forest trees of importance in the Eastern United States alone, and when we add to these the forest trees of the western Rocky mountain plateau and of the Pacific coast, and when we look forward to the attention which must be given in the immediate future to the planting of shade and forest trees on the great plains and in California, the subject of forest entomology assumes still more importance."

According to Kaltenbach the number of injurious insects which attack the forest trees of Central Europe is as follows:

Oak	537	species
Elm	107	"
Poplars	264	"
Willows	396	"
Birches	270	"
Conifers	299	"
Beech	154	"
Alder	119	"

It is apparent that neither the officials of the Department of Crown Lands of Ontario nor the members of the Royal Commission on Forestry Protection in Ontario consider

that insects do any injury to the forests, for in the report issued a few months ago, the insect problem is not even mentioned. Such an omission must be an oversight, due, no doubt, to the fact that none of the members of the Commission are entomologists. It would, indeed, be strange if our Ontario forest domains of such great extent form an exception to the general rule, and harbor no insects.

Dr. Fyles remarked that this paper dealt with a very important subject which deserves the serious consideration of the community. He then referred to the large areas in the Province of Quebec which had formerly been covered with forests of tamarac, but now were desolated by the ravages of the Larch Saw Fly and the timber rendered worthless.

Dr. Fletcher stated that the lumbermen usually say that in the Ottawa valley alone insects cause them a loss of a million dollars annually. This amount is merely an estimate, but it serves to show that they are aware of the losses caused by insects and realize how costly their ravages are. It is found that if the logs cut in the winter are not got into water, they will surely be attacked by insects and badly injured during the summer. A plan adopted in many cases is to turn the logs over from time to time during the summer so as to change the position of the portions exposed to light and those in contact with the soil; another method is to split the bark so that the inner part dries up and prevents the insect larvæ from living in it. These operations, however, are difficult to carry out, as the lumbermen cannot stand the flies which attack them in myriads during warm weather; this cause also prevents them from cutting timber in summer, which has been proved to be a better time than winter as far as the quality of the timber itself is concerned. The attacks of insects are always made upon dead or dying trees and such may usually be found on the edges of clearings where partially injured trees have not been cut down. In 1884 there was a great forest fire in the Ottawa valley, which left an immense number of burnt trees still standing. These were immediately attacked by insects and the loss would have been complete had not the owners of the timber limits at once set to work to cut and remove as much as possible of what was left. Any tree that is scorched with fire or partially burnt is sure to be attacked by wood-borers during the following summer.

Dr. Fletcher closed his remarks by moving a vote of thanks to Prof. Lochhead for his interesting paper; this was seconded by Mr. Dearness, and carried unanimously.

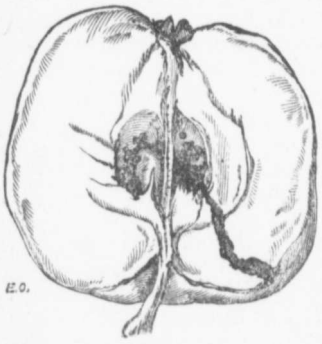
RESULTS OF SOME EXPERIMENTS IN PROTECTING APPLES FROM THE ATTACKS OF THE SECOND BROOD OF CODLIN MOTH.

By F. M. Webster, Wooster, O.

In Ohio, our attempts to protect the apple crop from attack by the codlin moth have given us varying results. Some years, spraying with the arsenites like Paris green, London purple and arsenite of soda have given excellent protection, and the apples have been very free of larvæ. Other years, though the spraying has been done with equal care and in proper season, the effect has been discouraging, to say the least. The causes for these varying results are not at all clear and there are some grounds, during some years, for the question as to whether, or not, it pays the orchardist to go to the expense of two or three sprayings and get so little in return for his labor, and other necessary expenditures, which spraying necessitates. Frequently the apples will pass through the season, up to late August, without exhibiting indications of the work of the apple worm, but after that the fruit seems to be seriously attacked and much damage done. There are with us, two periods of dropping of the wormy fruit. The first in late July and the fore part of August and the second setting early in September. Orchardists have declared that they could prevent the first, very largely by spraying, but the second baffles them. I have suspected, for a long time, that this was due to the attack of the second brood, and those who succeeded in protecting their fruit early in the season were, very largely, suffering from the results of moths developing in unsprayed orchards, and migrating during August to those that had been carefully and properly sprayed, thus infesting these after it is possible to protect them by the usual measures. In order to

test the probable efficiency of spraying, during the ordinary season for doing this, an experiment was tried in the orchard of Mr. William Miller, at Gypsum, Ottawa County, along the southern shore of Lake Erie. It was obviously impossible to get two trees exactly alike, and not easy to secure two greatly alike in close proximity to each other, but we selected two well in from the outer margins, and one of these we covered with netting, such as is used for covering baskets of peaches and grapes. The trees were sprayed for the last time on June 22nd and the covering applied the next day.

All fallen apples were removed from under both trees on August 29th, while there was a cessation in dropping of infested fruit, and, as we thought, all or nearly all of the first brood were thus eliminated. On September 14th, soon after the terrible wind that swept over the lake region, the spent tropical hurricane that devastated Galveston, Texas, there were removed from under the covered tree 229 apples, 59 per cent. of these being sound, their weight being 77 pounds. Under the uncovered tree there were 1,052 apples, only 10 per cent. of which were sound, and their weight was 214 pounds.



E.O.

FIG. 4.

October 22nd, there were picked from the covered tree 107 pounds of fruit; 372 apples were sound and eight wormy. Windfalls, 18, all wormy. From the check tree there were picked 128 pounds of fruit, 253 apples being sound, and 41 wormy. Of the windfalls, 94 were sound and 104 wormy. (Fig. 4 illustrates the familiar appearance of a "wormy" apple.)

Recapitulating, the covered tree, after the fruit was removed from beneath on August 29th, carried 627 apples. Of these, 372 were gathered in a sound condition and 26 were wormy. The uncovered tree, after fallen fruit was removed on August 29th, carried 1,544 apples, of which 347 were sound when gathered and 145 were wormy. The summary would read thus: Covered tree, out of 627 apples, gave 466 sound and 161 wormy; the uncovered tree, out of 1,544 apples, gave 452 sound and 1,092 wormy. This, I think, shows pretty clearly what the result would be if we could manage the second brood of moths, and also who is to blame for the disastrous effects of the second in well sprayed orchards.

There are two other points worth mentioning First, where a species is double brooded, the second brood is likely to be the most migratory in habits. Second, it is the outer rows in a well sprayed apple orchard that are most affected late in the season. Taking it altogether, the trouble does not appear to be with the spraying, but with those who do not spray at all, and who furnish the migrating female codlin moths that give origin to the second generation of worms in a well sprayed orchard.

In the discussion that followed the reading of the paper, Dr. Fletcher stated that he had that day seen a young larva about a week old, which evidently belonged to a third brood. It seemed clear that the best method of counteracting this insect was to spray for the first brood and bandage the trees for the second.

Mr. Bowman asked whether a late hatching of a third brood would not be a good thing, as then they would probably all be winter killed. Prof. Webster replied in the affirmative, and said that some years ago there was a severe frost in June, which nipped the leaves of the trees. Clisiocampa caterpillars had been very abundant, but they all perished from frost or want of food, and it was years before they became numerous again.

Dr. Fletcher mentioned that he had received some cocoons of the Tussock moth from Toronto, covered with eggs. They all hatched out recently under cover, shewing how near this species is to being double-brooded.

The next paper read was by Mr. Arthur Gibson, Assistant Entomologist of the Experimental Farm at Ottawa, on the "Life-history of Arctia Phalerata," in which he described in detail all the stages in the life of this insect from the egg, through the caterpillar and pupa to the perfect insect. As it was of a highly technical character, the paper has been published in *The Canadian Entomologist.* (Vol. XXXII., p. 369.)

Dr. Fletcher, at the close, remarked that such a paper as this indicated the lines upon which the best work should be done. It had been prepared with the utmost care and minute observations had been made at every stage of the insect's life. It was very important that life histories should be worked up in this way, as the imagoes alone are not to be depended upon in the separation of species. Very little is known about some of the commonest insects, and regarding others futher details are required to fill up the blanks in our knowledge. Every Entomologist should try to rear at least one species every year, and then a very great deal would be accomplished in the course of a comparatively short time. He then spoke of the mode of describing a larva, and explained Dr. Dyar's plan of numbering the tubercles and thus simplifying very much the work of description.

NOTES ON INSECTS OF THE YEAR 1900.

Division No. 2—Bay of Quinte District.—By J. D. Evans, Trenton, Ont.

During the past season the Forest Tent Caterpillar (*Clisiocampa disstria*) has done much damage in certain districts but not to such an extent as last season.

Grasshoppers caused some destruction to grain and pasture in some localities in the northern portion of the County, but only over comparatively small areas.

The pea weevil (*Bruchus pisi*) has come to be such a pest throughout Prince Edward County, that the seedsmen are looking for other and more suitable localities, in one case having transferred their operations in part to Lindsay.

The larvæ of *Phytonomus punctatus* were observed to be quite numerous in a clover field at Lake on the Mountains, near Glenora, Prince Edward County, on the 24th of May last. In very many cases the larvæ were curled up and encircled the tip end of the blades of grass, and apparently in a dying condition from either being parasitized or from some disease. At the same time and in the same clover field a number of examples were taken of *Hylesinus trifolii*, Muell. also eleven specimens of *Phytonomus nigrirostris*, Fab.

In July last unusual visitors appeared in a pear orchard owned by Mr. W. A. Warner and situated about 2 or 3 miles to the north-west of the town of Trenton. This orchard was about one acre in extent, in the midst of an extensive apple orchard, and had a few plum trees interspersed through it. About the third week of the month all the pear trees had their lower limbs swarming with small green caterpillars, there was no web nor did they suspend themselves by a thread, but seemingly dropped to the ground when satiated or when the tree was struck, then crawled towards and up the trunks again to the higher branches. The trunks of the trees and the ground, in places, were fairly green with the crawling masses of them. The caterpillars were from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch long when first noticed, of a dark green colour at one end and a lighter green at the other. The apple trees in the immediate vicinity had a few of the caterpillars but the plum trees were not visited by them. A thorough spraying destroyed them all. It was not until about two months thereafter that the writer became aware of their visit through a letter from Dr. Fletcher. The above particulars having been procured from Mr. Warner at such a long interim from their appearance, further information could not be elicited.

There has been a great scarcity of moths during the past season as compared with last, very few coming to light and they only of the commonest species.

Division No. 3.—Toronto District.—By D. G. Cox, Toronto.

Owing to other duties the writer has had very limited opportunities for observing the insect ravages of this district during the past season.

The Tussock Moth (Orgyia leucostigma) is still with us and has caused considerable damage to the foliage of the horse chestnuts in some localities. The civic authorities did considerable spraying of the foliage in the early part of the season which no doubt destroyed the young larvæ in large numbers. The pest appears to be diminishing and if they keep on fighting it, they will eventually succeed in getting it under control.

The Tent caterpillar (Clisiocampa Americana) was in considerable numbers on the wild cherry trees around the suburbs of Toronto, and many orchards were rendered unsightly by the tents. The Cabbage Butterfly (Pieris rapae) has been unusually numer-

ous this year in this locality, and the cabbage and cauliflower crop in many gardens has consequently been considerably damaged by the larvæ of this common pest. The cabbages were so badly perforated by the caterpillar as to render them unmarketable. I observed also in gardens where no cabbages were grown, that the turnips and radishes were severely attacked by this larva.

During a trip taken through Scarborough and Markham townships in the latter part of July, I visited several farms and found considerable damage had been done to the turnip crop by what appeared to be the larvæ of (Noctua C-nigrum). In some fields 40 per cent. of the crop had been cut off and the farmers were re-sowing seed in the bare places along the rows that had been destroyed. I did not know the best remedy to recommend to prevent the ravages of this cut worm, but advised them to apply to Dr. J. Fletcher, the Dominion Entomologist at Ottawa, who would give them valuable information which would be of great benefit to them in combating the ravages of the insect.

Around one of the farms I visited there were planted about two-thirds of a mile of European Mountain Ash trees (Pyrus acuparia). These trees were about fifteen years old and were so badly infested with the larvæ of the Flat-Headed Apple Tree Borer (Chrysobothris femorata) that the writer picked from the outer bark of one tree ten young larvæ about five-eighths of an inch long, several other trees were examined in the row and found to be in the same condition. Quite a number of the trees had already been killed by this pest. I advised our friend the farmer to pick out as many of the larvæ as he could during the months of July and August, after that they would have penetrated into the heart of the tree and consequently could not then be reached. I also told him to paint the trees next spring with a thick solution of soft soap and washing soda before the beetle oviposits so that the young larvæ will have difficulty in penetrating the bark. The ravages of this beetle seem to be confined more particularly to the trunk of the tree; from the ground up to the first branch. I found no evidence of larvæ above the first branch in any case.

The Spruce Gall-louse (Chermes abietis) does not appear to be so abundant in this locality as formerly.

Division No. 4.—Hamilton District—By James Johnston, Bartonville.

Want of time during the past season has prevented me from doing but very little insect collecting so that my brief report is mostly made up from my observations on the farm during my daily occupations.

During May and most of June cut worms were very troublesome, being more numerous than I have ever known them to have been. Systena blanda, Mels (the pale-stripped Flea-beetle) has been quite numerous. Eight years ago when I first noticed these little beetles, they seemed to confine themselves almost entirely to rag-weed, but each year since then they appear to be taking to other plants as food, and now they may be considered destructive to turnips, pumpkins and strawberries. Last season a few choice pumpkin seeds were planted and in the course of a short time when I went to see how they were doing I found the plants thickly covered with these beetles making them appear as if sprinkled with ashes, and, on my approaching, they all vanished, being very quick.

July 22nd, Crioceris 12 punctatus, Lin. made its first appearance in our asparagus patch when I took seven specimens. As the season advanced they increased in number so that I fear by next season it will be reckoned amongst our already too numerous garden enemies.

Aug. 17th, Colias eurytheme, Bd. In crossing the clover meadow where C. philodice was very numerous I noticed this orange-colored beauty which I secured with my sun-hat after a hard chase. It is a beautiful large specimen which is of double interest to me as it is the first of the species I have taken, and differs from those in my cabinet by having the front half of the fore wings a pale yellow.

Aug. 30th, Nonagria subflava, Gr. This is the third specimen of what is, as far as I can learn, a rare insect during my years of collecting. I took it in the house having been attracted by the light in the kitchen.

Aug. 31st, Catocala nebulosa, Guen (1 spec.) and C. Robinsonii, Gr. (2 spec.).

These two species I consider an interesting capture as both species are new to my collection and possibly to Canada as I have never heard of them as being Canadian species.

This I should say has been a year favorable for this very interesting genus as they have been unusually abundant in this locality. I missed all the early kinds as I was unable to look after them before Aug. 18th, but after that succeeded in taking seventeen species, amongst them four C. desperata, Guen., of which I never took but one, and it several years ago, and a doubtful specimen, possibly a variety of C. paleogama.

In the early part of the season I noticed that some insects were doing much damage amongst the strawberry plants by eating the heart leaves while young and tender and I was at a loss for some time to discover what they were, but finally I detected a black beetle doing the mischief, and by keeping watch I saw several doing the same thing so I have made up my mind that they are the mischief makers. They straddle the leaf and very soon destroy it as they eat quite greedily.

Division 5.—London District.—By R. W. Rennie, London.

That most exasperating of all injurious insects, at least to the average gardener, made its appearance last spring in unusually large numbers, viz., the Cut Worm, mostly the larvæ of *Hadena arctica*. There seems to be a considerable amount of uncertainty in regard to the appearance and disappearance of this insect.

In 1895 the moths were flying in immense numbers. The following spring the larvæ did great damage, but when the time arrived for the appearance of the moths, those of us who were expecting a great number, were disappointed, as very few appeared.

Again this year, the larvæ were exceedingly plentiful, but the mature insect, at the time it should have appeared, was in very small numbers. I have not seen any explanation offered for this heavy mortality amongst the pupæ. Remedies proposed:—Placing bunches of grass, clover, etc, saturated with Paris green along the rows. This is of very little use, the young larvæ are not such fools as to eat withered foliage, when they can get the fresh article right at hand. But a mixture of bran and Paris green seems to be very much to their taste, while not neglecting the plants altogether for the bran mixture, they are more inclined to try it than anything that has been proposed up to the present.

Cabbage root Maggot.—This insect has been quite destructive this year, the only remedy so far that has been beneficial has been to wrap the stems of the plants when transplanting with tar paper. In the August number of the "Canadian Horticulturist" there is a suggestion from one of the staff of the Guelph Agricultural College, namely, to try a tablespoonful of carbon bisulphide in a hole at the base of the young transplanted plant. This may prevent the mature insect from depositing her eggs on the plant, but, with carbon bisulphide at twenty cents per pound, and cabbages at twenty cents per dozen, I think that the gardener had better quit growing cabbages. The cost for carbon alone will be about ten cents per dozen plants. The recommendation of such a dangerous insect destroyer as carbon bisulphide I think should be condemned; it may answer very well for laboratory experiments, but in the hands of the general public, may be the cause of numerous accidents, which will result in all probability in a general distrust by the public of trying any new insecticide with the chemicals of which they may be unfamiliar.

Red Spiders.—This mite has been very destructive this year to growers of sweet peas. It has got to be such a pest that most lovers of this flower in this section will be forced to abandon their cultivation. Last season, although a grand season for the pea family here, was very short, ending about the middle of August, due almost entirely to the ravages of the red spider.

Cold water spraying is not sufficient to keep them under control. To apply an emulsion you will have to have a pump capable of delivering the emulsion at at least thirty-five pounds pressure.

Root Aphis.—This pest appeared in quite large numbers this year attacking sweet peas and asters. I have seen no preventative proposed. Aphides were very numerous this season. I have seen whole fields of cabbages almost entirely covered with them. Spray with kerosene emulsion, or if you have a water pressure of sixty or seventy pounds use water only.

NOTES ON THE SEASON OF 1900.

By J. Alston Moffat, London.

Ravages by cut worms were reported to me from far and near as being unusually severe. And several kinds of moths presented themselves to my notice in conspicuous profusion later on, as probably coming from such worms; such as *Agrotis C. nigrum*, *Mamestra devastatrix*, *Hadena arctica* and several others in lesser numbers, whilst toward the end of the season *Agrotis subgothica* (Fig. 5) was in great abundance.

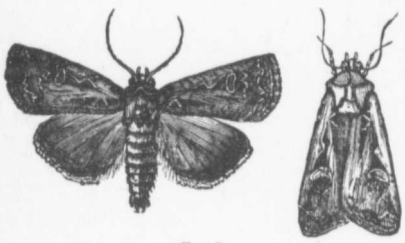


Fig. 5.

A most unusual outbreak of *Crambus exsiccatus* made itself manifest in the early part of June, and lasted well into July. Early on Sunday morning, June 10th, I was walking down the delightfully quiet street, when my attention was attracted by the singular appearance of the pavement in front of me. I thought it was covered with peanut shells, broken up very fine, and fancied some boys had been having a feast on the previous evening, but on reaching the spot I found the strange appearance to be produced by the wings of that moth. I looked up, and there was a restaurant lamp overhead, and the light from it had dazzled the moths and brought them down, when they got trodden underfoot by the travel of the previous evening, until the stone pavement, for a space of eight feet in diameter, was literally put out of sight with their remains. How many deep I could not say. If this was but one of many such "slaughter pits," which it is reasonable to believe was the case, then how little conception one can form of the multitudes of them that were destroyed in one night; whilst it made no perceptible reduction to the numbers left in the fields or at the lights. Then to think of the injury done to crops—grasses mostly—during the feeding up of the larvæ for the production of such swarms of moths, whilst the cause of such injury would be all unseen and unsuspected by those suffering from their depredations.

The notorious "Buffalo Bug," sometimes most misleadingly called "moth," to which it has no resemblance, it being in reality a beetle, *Anthrenus scrophulariæ*, Linn. (Fig. 6 *d*), has become an established pest in London. Early in the year I took the beetle on the windows of the Y.M.C.A. building; and complaints of its depredations were heard from various parts of the city during the summer. About the first of August two larvæ were brought to me by a lady; one seemed full-fed, the other about half grown. The one pupated about the first of September, and gave forth the beetle in October, the other was still feeding at the end of the month, but died before maturing. The larval stage is the only form of its existence known to the majority of housekeepers, which is correctly represented at Fig. 6*a*, greatly enlarged, the line at the side indicating the natural size, and they would hardly believe that the beetle at *d* was the same insect, or one from which they had anything to fear. The beetles are black, ornamented with white and red, but are extremely variable; so much so that three forms have received distinguishing names. It is a European insect, but there it is spoken of as a "Flower Beetle," although known to enter houses and destroy "furs, clothes, animal collections, and even leather and dried plants." It was on this continent that it first obtained its notoriety as a carpet pest, the habit here of tacking down carpets for a year giving it a splendid opportunity to propagate undisturbed; with this, as with others of its kind, frequent

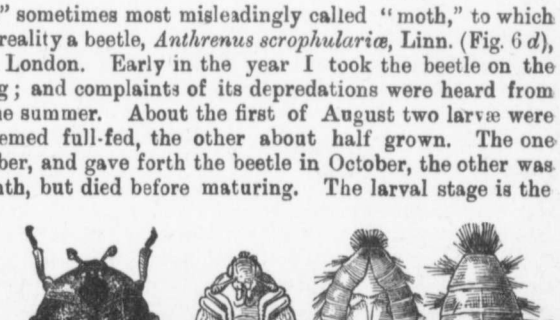


Fig. 6.

stirring up is an excellent means of deterring them from indulging their destructive propensities. And now that it is here to stay, as it is not entirely depending on indoor propagation, so cannot be exterminated except locally, there is nothing for it but to give it due attention ; and to combat it successfully, a knowledge of its nature and habits must be acquired.

Having learned to recognize the beetles, they may be seen upon the windows in early spring and destroyed before they have an opportunity to deposit their eggs, and thus prevent future trouble from them. In nature it takes a full year to complete the round of its existence, but with the artificial warmth of houses it matures in shorter time, and beetles may be found on windows before the end of winter.

When once a dwelling has become infested, not only should the carpets be thoroughly beaten, and disinfected, but narrow strips of thin muslin should be fastened over the joints of the floors with varnish before relaying, so as to prevent them secreting themselves there. A strip of tar paper laid under the outer edge of the carpet is an excellent preventative.

When they are known to be at work and it is not convenient to lift the carpet, benzine will kill any living insect that it is brought in contact with, but great care must be exercised in not allowing a light to approach it while it is evaporating, as it is very inflammable. A damp cloth and hot iron will also effectually arrest the operations of any depredators upon whom they are applied. Steam or benzine may also be used to advantage to get rid of their presence in upholstered furniture ; by such means can their operations be restrained and rendered comparatively harmless. But constant watchfulness against their presence is required, for even if a dwelling has been freed from their presence during one season, the beetles may enter at the open windows the next summer and start a colony afresh.

There is another beetle with similar habits belonging to the Dermestidæ, *Attagenus piceus*, Oliv., whose larva is about the same size and hairy character as that of *Anthrenus scrophulariæ*, which it closely resembles and might easily be mistaken for, as they are sometimes found associated ; but the beetles are quite different in appearance, *Attagenus piceus* being much longer than wide, a flatter insect and entirely black. This also will have to be guarded against, as it is just as destructive a carpet pest as the other, and in some instances becomes the most numerous of the two. For some time past it has been more troublesome in the Society's collection than *Anthrenus varius*, which is supposed to be the standard museum pest.

A friend in the country, in one of his recent letters to me, conveyed the following item of information, which may serve as a warning against the employment of cheap labour : "We got lots of help to thin our turnips this year. Some big green fellows came along who gave us their assistance and worked for their board ; but they made a bad job of it. After we had thinned some rows they would go round and thin them over again, and they left nothing whatever in some rows, but that may have been because they worked at night and did not see what they were doing."

During the remarkably fine weather we were favored with during October, winged *Aphis* were in great abundance, and made walking on the streets quite unpleasant, especially where there were shade trees. One evening when the setting sun illuminated the hazy atmosphere and the tiny wings reflected the light conspicuously and made each individual stand out distinctly, I made an effort to estimate how thick they were. By stopping at different points and watching closely, I estimated there was one to every four inches of space. Before they had all gone, those mosquito-like merry dancers (*Culiciformis*, Latreille, some of whose larvæ live in water and others feed on fungus,) made their appearance, who from some inherent perversity of their nature, congregate in living columns over the sidewalks, with their densest portion about the level of one's face, which one must either go through or turn off the walk to get round, when one would think that any other portion of the street would serve the purpose just as well. One warm summer's day, I took a seat in a pleasant shade, put my light colored straw hat on my knee, when one of these groups formed over it and commenced a jig close to my face, some of them striking it. I swept them away several times but they always returned and gathered as before. I began to suspect that the hat was the centre of attraction, so I placed it on the seat an arm's length away, when they immediately formed their dancing party over it there and kept it up until I took it to leave. So it would seem as if they liked to have some conspicuous object beneath them to keep the crowd in line.

There was sent to me by Mr. J. Tanton of this city, a most singular looking creature of the class *Myriapoda*, and shortly after another was brought by Mr. C. E. Abbott, both of them supposed to have come in packing, and had attracted their attention as something quite unusual. From information received by me at our annual meeting, it proved to be *Cermatia forceps*, Rafinesque, of the family Scutigera, and the first reported appearance of it in Canada. There is an excellent figure of it in the fourth report of the N. Y. State Entomologist for the year 1887, page 129, and from that article I have gathered the following information: It is properly a southern resident, but has been gradually extending northward, until it has now become well established in most of the eastern States. Its body is when full grown, about an inch in length, with a uniform width of a quarter of an inch, but rather narrower at the hind end. It has fifteen pairs of long legs which terminate in a black, sharp hook. The front pair of legs are about half an inch in length, the others gradually increasing in length to the second last pair, which are about an inch and a quarter, whilst the last pair are an inch and a half or more. It is known to be carnivorous, feeding upon insects, for which it enters and frequents houses, and when seen for the first time, is sure to attract attention by its grotesque attitude and rapid movements, and may even create alarm; but for which there is no cause, as it is extremely timid and anxious to escape. Yet, from its anatomical structure it is suspected that it may be poisonous, but there is no authentic instance recorded of its ever having inflicted injury to a human being. From Insect Life, Vol. 3, P. 85, I copy the following: "Mr. Webster spoke of the predaceous habits of *Cermatia* and its preying upon the Croton bug. Mr. Fletcher had observed the insect with Mr. Howard, at Washington. Its mode of capturing the Croton bug before devouring it was remarkable. It sprang over its prey which was thus encaged between its many curved legs."

The unusually warm weather in October, had the effect of bringing to maturity great numbers of the Tomato Sphinx, and many were captured on the wing. I secured a fine, fresh specimen on a shop front in the principal thoroughfare of the city on the morning of the 19th.

Anosia Archippus was noticably scarce through the season, as compared with the previous year, and yet Messrs W. E. Saunders and H. Gould saw them on the 19th of September, accumulated in such multitudes on the trees at Point Pellee, as to put the green of the foliage out of sight, whilst the lower branches were drooping with their weight. On the 27th of October, the janitor of the Y. M. C. A., brought me a living specimen which he had taken from a bush, helpless from the coldness of the day; bright and fresh, as if newly hatched. It was very lively in warmth and sunshine, and fed freely, but dormant when the room was cold. On two occasions it remained in the same position from about four o'clock Saturday afternoon, until near noon on the Monday following. On the 13th of November, I allowed it to remain too long on a frosty window, from which it never fairly recovered, and it died on the 16th. It retained its bright colors to the last. It was a female. I opened the abdomen and made a microscopic examination. It was very fat, but I could see nothing whatever to indicate the presence of eggs.

ANOSIA ARCHIPPUS, YET AGAIN.

By J. Alston Moffat, London.

In a series of most interesting and instructive articles on the Migration and Dispersal of Insects, by J. W. Tutt, F. E. S, editor of "The Entomologist's Record and Journal of Variation," London, England, after a reference to the methods of many different insects, he arrives in due course, in the July number, 1900, to a consideration of what has been written upon the movements, spring and autumn, of *Anosia Archippus*, Fab. (Fig. 7) and the claims that have been put forth for it, as differing in many respects from all other butterflies. The opinions that he has formed from a consideration of what has been written upon the subject, and the conclusions he has arrived at upon it, can be gathered from the following extracts taken therefrom:

"So far as one is able to get at the real facts (i. e., apart from the opinions of observers,) one is able to conclude that the movements of *Anosia Archippus*, in North America, are very similar to those of *Pyrameis cardui*, (the Thistle butterfly) in Europe." After quoting from various sources, Mr. Tutt adds: "All these irregularities of habit will be certain to strike one who has studied the subject, as being readily paralleled during a series of years by the immigrants of *Colias edusa* and *Pyrameis cardui*, and their progeny in our own country." That is, Britain.

After quoting a diversity of individual opinions and contentions, he continues, "However little definite information there is about the spring migration of *A. archippus*, a great number of observations have been recorded of a habit that is certainly unknown in any of our most observed Palæarctic migrating species. This is the habit of swarming in the autumn." He then gives a large number of instances that have been observed by different persons, of autumnal swarms passing over various parts of the continent; then continues, "One other observation may be added, that of Bowles, who states that he has himself seen the shores of Lake Ontario, near Brighton, strewn with hundreds of their dead bodies, cast up by the waves, and which no doubt had formed part of a swarm, which from weakness or some other cause had perished while flying across the lake." Then Mr. Tutt sums up his conclusions upon the subject thus:

"From these and similar observations it has been concluded that the swarming of this butterfly in autumn is analogous with that of birds before commencing their [flight

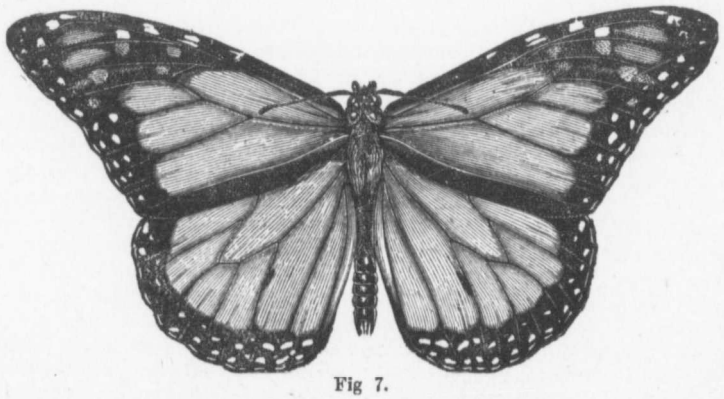


Fig 7.

southward, and that, after swarming, the butterflies return to the sub-tropical lands whence their grandmothers and great grandmothers set out in spring. It is admitted that the climate is such, in the northern territories to which the species annually spreads, that the butterfly cannot possibly exist in the winter, and Riley, who first propounded the return theory, himself confesses that "under the most favourable conditions a large majority perishes." As we have said, Scudder accepts the theory as fact, and practically writes as if it were proved beyond question of dispute. For ourselves, although we know of no exact analogy among butterflies of a similar swarming habit, yet, in every other respect the similarity between the habits of this species and our own European migrating species, *Pyrameis cardui*, *Colais edusa*, etc., is so great, both as to the continuous-brooded habit, and also as to Dr. Thaxter's observation that the males and females in the autumnal swarms pair, that we are inclined to doubt the conclusion. It has never yet been shown that the journey has been successful. The swarms are sometimes noted as going in a different direction from that assumed by the theory, and much more evidence is necessary before even an approximation to success can be admitted. For ourselves, we doubt whether the return journey has ever been successfully made, and we consider that there is altogether insufficient direct evidence to warrant the assertion that the autumnal swarms of *Anosia Archippus* migrate from the more northern parts of its summer range in America, to the south, in order to winter there. Some of the quotations which we have just reviewed, and others mentioned by Riley, how distinctly that he swarms do sometimes fly more or less from north to south, or from north-east to

south-west; but the general opinion that one is compelled to form, after reading most of the notes relating to the autumnal swarming of this species is, that the large congregations of butterflies that then collect will, given fine calm weather, stay long (in swarms) in one place, and the evidence is altogether insufficient to show that these go south-west rather than in all (or any) directions apart from weather conditions."

When one's opinions are distinctly challenged, one naturally feels a desire to vindicate them; and as there is much in these quotations that is in direct opposition to my belief on the subject, which has been largely formed upon actual observation, influenced no doubt by what I have read, I shall review them somewhat in detail, in an attempt to make it clear that I, and many others on this continent, have not wholly misunderstood what we have seen. Mr. Tutt seems to be needlessly skeptical on some points, in view of what he informs us of the wonderful performances of this butterfly, which he appears to accept; and I doubt not that a little personal observation would convince him of it.

I know nothing of the habits of Pyrameis cardui in Europe except what I have read; but in this country, my attention was soon attracted by its periodicity when I began collecting. I have seen in some seasons, cloverfields just alive with fine, large, rosy specimens; whilst in others I have watched carefully for them all summer and not seen one. I have seen its larva in such numbers as to consume all the thistles in one field, and cross the road in masses to another for fresh food, whilst the whole neighbourhood became alarmed that their crops were to be destroyed by an invasion of the army worm. I came to the conclusion that they appeared every third year; and sometimes then only in very moderate numbers, yet I never observed anything in any of its peculiar habits, to in any way correspond with those of Anosia Archippus. It is rather unsafe to draw, confidently, conclusions from analogy when dealing with insects.

In the quotations made by Mr. Tutt from the few recorded observations made by different individuals, of the movements of Anosia Archippus; their gathering together in swarms preparatory to their migrating, and their passing over the country in flocks, have got somewhat mixed, some of them referring to the one, and some to the other. All admit their assembling; the purpose of their assembling has to be inferred, which gives plenty of scope for the play of the imagination. The butterflies take weeks in collecting before they depart. Having chosen their rendezvous, they have to come together from a considerable extent of territory around, to accumulate the multitudes they often do, and that takes time. How those at a distance get to know of the spot is a very interesting and puzzling thought, but that they do in some way is a fact. Now, it is during this gathering process that the coming in the evenings and the going in the mornings has mostly been observed, and is usually kept up for a length of time, regardless of the weather. No one observing these movements could help wondering and enquiring what the object of such conduct could mean; and if informed about their migratory habits, and watching them to the end, he would be satisfied that it was in some way intimately and directly associated with their intention to leave, and was preparatory to that very purpose. We cannot tell how their minds act in connection with the subject; we can only express our convictions in accordance with the operations of our own, drawn from observation. As the time approaches for their departure, which for this locality is about the first of September, the great majority that compose the swarm, gets into that singular dormant and listless mood, which is another very perplexing state of mind to account for, but which no doubt is also intimately associated with their future intentions; they will remain for days in what appears to be a state of semi-hybernation, when they show no great desire even for food. I have only once had the pleasure of watching one of these swarms assembling, but from all accounts it was quite characteristic of their doings at such a time. Some of my published observations will allow of expanding and commenting upon.

The woods where I saw the assembling of *A. Archippus* as recorded in Can. Ent. Vol. 12, p. 37, was that in which the asylum buildings at Hamilton now stand. My visits to it were made every other day. I saw the butterflies there three times, which would cover five days, and to the last they were perceptibly on the increase. I would get there about half past one, when I would find them hanging in clusters, quite motionless except when disturbed. That they should be there at that time of day, in that condition, caused me to wonder greatly. Whether they had been out in the morning or not I cannot say;

but when I would be leaving about half past five, individuals were still arriving, and some of them had to descend quite a distance to the tops of the trees as if they had traveled from afar, and not at all like ones that had been feeding in the vicinity. During these observations the weather was fine, what it may have been when they left I do not know as I did not see them go, which must have occurred within three days after my previous visit. The swarm that I saw just starting out on its journey, Can. Ent. Vol. 20, p. 138, was in a locality about thirty miles east of Hamilton. I was there upon a visit, and had gone out to a field, with many bushes about stumps and fence corners, to look for moths and beetles. Whilst engaged in my search, my attention was diverted by the numbers of *Archippus* that were floating around me. When I looked up I at once realized what was going on. My eye traced the stream to a wood from whence it was issuing, which was on the far side of the field, and thither I made my way. As soon as I entered the wood I was struck with the contrast which the attitude of these presented to those of my former observation. There, quiescence; here, animation. Everywhere I looked there was movement; but not of the wings. The whole swarm was evidently controlled by one impulse; and in presence of it I could not resist the conviction that it was associated with their going. Were they just arousing themselves from a previous state of lethargy? The seemingly few that were on the wing and making for the open were coming from the far side of the wood, which was out of my sight, as well as of those that were near the front, and were closely following those that had already started. And this gives us a clear idea of how these long drawn out flocks that are so often seen passing over different parts of the country are produced, and I have always considered myself as particularly fortunate in seeing this illustration of how it is done. Although those high in the air were keeping to a comparatively direct course, there were hundreds of them in sight that were swooping and swirling around the bushes in the field; yet they never allowed a gap to form in the procession. The weather at the time was fine; no storms in view, past, present or prospective, to influence their movements.

That swarms will encounter storms, both while forming and upon their travels is certain, and that their movements will be to some extent modified by them is also certain. But my conviction is, that they will invariably choose fine weather for starting on their pilgrimage. Here is what Mr. J. A. Allen has to say of their movements in Iowa. Trans. Chic. Acad. Sc., i. 331. "This extremely abundant butterfly seems to prefer the open prairie, but is driven to the groves by the winds which sweep furiously over the prairies in the summer months, and especially in September; here the butterflies are collected in such vast numbers on the lee sides of trees, and particularly on the lower branches, as almost to hide the foliage, and give to the trees their own peculiar colour. This was seen not in one grove alone, but in all of those that were visited about the middle of September. If unmolested, they remained quietly on the trees; if disturbed by blows upon the trunk or branches of the tree they would rise like a flock of birds, but immediately settle again, either on a contiguous tree or upon higher branches of the same. At New Jefferson, a little later in the year, when the gales had abated, they were seen leaving the groves in vast flocks, and scattering through the air almost beyond reach of the eye." There we have a picture presented of collecting swarms. But I suspect that Mr. Allen has slightly mistaken the purpose of their collecting, which was not so much to obtain shelter from the furious winds, as to prepare for their future journey, as disclosed by their leaving later on. My impression is, they rather enjoy a stiff breeze, and understand well how to manage themselves in it. But what interests us most in this connection, is, that they did not start out until the gales had abated.

That these autumnal swarms of *Anosia Archippus* leave the northern portion of the continent and go southerly, is, I think, the firm conviction of most, if not of every entomologist in North America. Which is not surprising when we know that they have never been seen going in any other direction in the northern portion of it. That but few observations have been recorded by competent persons, compared with the importance of the subject, is acknowledged by all. That there are so few interested and competent individuals on the routes these swarms travel, to make observations, compared with the extent of territory over which they have to pass, is confessed and lamented by many; yet the few observations that have been made, defective as they are, when dates and localities are tabulated, exhibit a progressive movement in that direction, which sus-

tains and confirms the general opinion on the subject. Take these which are referred to by Mr. Tutt:

Saunders, Port Stanley, September 1st.
Scudder, New Hampshire, do 2nd.
Peabody, Wisconsin, do first week in.
Dr. Hamilton, New Jersey, do do do
Mundt, Illinois, do 7th.
Anonymous, Ohio and Indiana, September 19th and 20th.
Dr. Ellzey, Maryland, do 23rd and 25th.
Dr. Neal, Texas, October 4th and 6th.

Dr. Thaxter, Florida, being without date, may be placed anywhere between 1st November and last of February; whilst he is reported in another place as having said, "that he had found *Archippus* wintering along the Gulf of Mexico in immense numbers." Which taken in connection with the fact that there is not enough of their foodplant there, to produce a tithe of them, is strong presumptive evidence that those there seen had come from the north, where we know they are bred in countless numbers. That many of the travellers will perish by the way is what is to be expected, but that the bulk of one of these swarms could not complete the journey from their northern limit to the Atlantic coast, is not to be thought of in connection with a butterfly that has succeeded in reaching a land 2000 miles across the ocean from the American continent.

In reference to Mr. Bowles's observation, Can. Ent. vol. 12, p. 134, which was a valuable addition to our information of its habits at that time, but proves nothing, except that the butterfly is a wanderer and liable to be overtaken by a storm and perish, whilst in the act of crossing our great lakes; I have seen specimens of it that were thrown up with the drift on the north shore of Lake Erie. I have seen the west shore of Long Point strewed for miles with their wrecks after a storm. And I have picked up some of them, apparently dead, placed them in the sunshine and seen them revive and fly away. These were bright fresh specimens of that season's production. But that any of them had fallen into the lake from exhaustion by long continued flight, I would say for that butterfly; never! Its mode of flight is so easy and graceful, that it looks as if it could remain on the wing indefinitely without tiring; it indicates amusement rather than labour. It never appears to be in a hurry; unless it has got a fright, and then, racehorse speed is slightly suggestive. During oviposition, the female gives one the impression of her being intent on business; and moving from place to place with great speed; but her progress is made in long sweeping curves, with scarcely a flutter of the wings, which does not suggest exertion. It has a dexterous way of using a strong breeze to help it along. I have seen one go up the side of a two-storey house and over the roof without a flap of its wings. All it required to do, was to set itself at the proper angle and the wind did the rest. Even when they have started out upon their long journey southward, those near the ground do not reserve their strength by refraining from amusement. With many a sweep and swirl they are up and down, here and there and all around, yet never allowing themselves to fall behind the steadily advancing stream. Mr. Alexander of Her Majesty's Customs Department, Hamilton, informed me that on one occasion he was crossing Lake Erie from the American side, and that they sailed for hours through a flock of *Archippus* going in the opposite direction; and when the steamer reached Port Dover the butterflies were still going out over the lake. And from his description of their behaviour on the water, it corresponded exactly with what I have so often seen upon land; some high in the air, others skimming over the surface of the lake, or dotting the space between, whilst many found time to come on board, and investigate the mysteries of the deck.

As to its "continuous-brooded habit," I have never seen the slightest indication of such a thing in Ontario. From the time that freshly emerged specimens appear in July, to the time they depart in autumn, they never show the least regard for each other sexually. So marked is this feature of their conduct during that time, that it was asserted by some, that those great gatherings of them were composed entirely of one sex, but this was soon proved to be not the case: yet it brings to view how much that peculiarity attracted attention. Dr. Scudder claims "that no Anosia Archippus born northward ever lays eggs the same season;" and I am quite prepared to believe it. On one occasion I obtained a chrysalis of that butterfly in the latter part of October, which matured by the

6th of November. Was this an attempt at producing a second brood? Reasoning from analogy one would unhesitatingly say, yes. But from all my observations of that butterfly, I as unhesitatingly say, no. It was but a retarded specimen from a more southerly born parent; and would probably not have matured in nature at all. It is no unusual thing to find dead chrysalids after frost that give no indication of being parasitised. Although Dr. Thaxter saw some of them in Florida making an attempt at producing a brood there, yet the fact that they were still in swarms, clearly indicated that their time for breeding had not yet come, or they would have been dispersed. Now then, seeing that fresh hatched specimens begin to appear here about the middle of July, and continue on the wing in increasing numbers to the beginning of September, when a great proportion of them takes their departure; and that portions of these same swarms may reach the latitude of Maryland about the end of September, Texas and Florida in October and November, that they winter along the Gulf of Mexico, or even further south, and that it will be the end of February or the beginning of March before their regular time of breeding begins, and that we have not the slightest reason to believe that they hybernate at all, anywhere, as *Antiopa* and the *Graptas* do; there seems to be a reasonable excuse for the belief that *Anosia Archippus* is a long lived butterfly, and that continuous-lived would be quite as appropriate for it, as continuous-brooded.

That any *Anosia Archippus* leaving Ontario in the autumn, will return to it in the spring to propagate its species, is a matter upon which we have no information whatever; and seems quite improbable. But that the first ones that appear here do come from the south of us, admits of no question. Yet the terms "north and south," are often used in such a loose and ill defined manner, as likely to cause confusion. Hence Mr. Tutt has tripped over my "doubtful logic," when speaking of their going south in the autumn, and returning in the spring; when it was the "species" that I meant, and not the individuals; which I ought to have made more clear.

There are but two statements that I can find, that provide any basis upon which to form a calculation as to the distance from which our first arrivals may have come. Edwards speaks from West Virginia, Riley, from Missouri. West Virginia is a long way south of Ontario; so we are not warranted in concluding that the behaviour of *Anosia Archippus* there will be identical with what it is here. Edwards in his life history of *Danais Archippus* (Psyche, Vol. ii, Dec. 1878, p. 169,) says: "In this part of West Virginia, *D. Archippus* is, I have reason to believe, four-brooded, and the butterflies of the last brood, and these alone, hibernate. The survivors appear very early in the next spring, and are always faded and more or less broken." And through that whole history, he makes his estimates upon the principle that it is a hibernating butterfly. Now the fact that Dr. Thaxter found it wintering along the Gulf of Mexico, utterly precludes the idea of its hibernating in any true sense of the word. So Mr. Edwards's "survivors" came from a good way south of West Virginia. Riley also speaks of it in the same way; which was quite excusable at that time, as facts to the contrary had not been disclosed, and they reasoned from analogy, and so the habit has been kept ever since; but we must now view it another light. Edwards's spring dates are, butterflies appear the last of March. Eggs laid the second of May, butterflies from these, thirtieth of May. Riley, 3rd annual Missouri report, p. 144, says: "They commence depositing eggs in the latitude of St. Louis during the fore part of May . . . Butterflies from these eggs begin to appear about the middle of June." These are the only observations made in the south, giving dates, that I find to estimate time and distance by. Now *Anosia Archippus* makes its appearance in Ontario about the first of June and before, according to the season. Are our first arrivals specimens that were born in either of those localities, or there-about? Certainly not from the Missouri broods. But West Virginia is the most likely direction from which our first visitors would come; and here again we see, that there is not sufficient time for the first Virginia bred specimens to make the journey to Ontario. Then whence do they come? Our only answer must be; from some broods born much further south than West Virginia.

As to "swarms going in the opposite direction," we have no spring swarms in the north. And those observed and recorded in the south, do not seem to seriously conflict with observations made in the north. The "bevy" that was seen in Texas the last day of March, containing thirty individuals, would not be considered in the north of sufficient importance to notice which way they were going. The report received by Riley from

Mr. Wells of Kansas, of a swarm which he saw in the middle of April, "that came rapidly with a strong wind from the north-west," seems to be of somewhat uncertain interpretation. But there is one thing I feel quite certain of, let Anosia Archippus, wherever, or in which ever direction it might be going, get caught in a gale it would head against it. I have seen individuals of them out in a gale that I could hardly hold against; low down, slowly but steadily making their way in the opposite direction, and that with little apparent flutter of the wings but with them closely reefed, until tired of the monotony of the procedure, or not wishing to go any further in that direction, they would suddenly shoot up and get hurled fifty or more feet in the direction they had come, then turn and go through the same performance over again. They may do the same in flocks, who can tell?

If I were undertaking to draw up a programme of the proceedings of this butterfly from my abundant lack of information; and filling in what I don't know with what I think is most likely, it would be something like this: *Anosia Archippus* is a southern butterfly, which has inherited a powerful migratory instinct, and is endowed with a capacity to indulge it to the utmost limit of its inclination. The northern portion of the American Continent, is where it finds the conditions most favourable for the multiplying of its species to an unlimited extent. But it cannot endure frost, therefore goes southerly in autumn, and with that purpose in view gathers into immense swarms before it starts out. It makes the journey in easy stages, spending months on the way. As it does not hibernate, it keeps on the move south-west until its breeding season comes round, when these, or more southerly bred specimens, start the northerly movement. Reference has been made to the habit of birds; an excellent comparison for my purpose. We know that they leave their southern residence for the north at a suitable period of the year, and by the time the species has reached its northern limit, the whole continent is uniformly stocked. No part missed, no part burdened with an over supply, and we know that the southern ones will be breeding before the northern ones have commenced building. Apply the same principle to our butterfly; only she has no building to do, and no care to take of her young, so she is not required to settle down in one locality, but may place one egg here and another there as she finds it convenient and pass on. Now I will accept and be guided by Mr. Edwards's observations in West Virginia, as to her conduct there, but not his conclusions. He says, (Psyche as previously quoted,) "The survivors (from hibernation) appear very early in the next spring, and are always faded and more or less broken (From much exposure and long travel as I believe) They may be seen * * * the last of March; * * the females deposit their eggs the last of April and early in May on the leaves of different species of Asclepias, beginning as soon as the plants are well out of the ground, and thereafter, without doubt, soon die, after the manner of their kind." In that we learn, that our southern born butterfly was not in a condition when she reached West Virginia to oviposit. That it took a month to mature her eggs. How many of those who started out with her, spent that month in going further north, and so have reached Ontario about their usual time? A few butterflies will stock a locality with a species, if eggs are all laid together at one time; which I think is not the case with this one, hence the absence of well defined broods. And Mr Edwards proved that they do not "soon die" after finishing egg laying by capturing one on the 2nd of June, with her ovaries quite empty. So here we have still an interesting question to settle, how long do they live before finishing, when they survive for sometime after? Again Mr. Edwards says, "every female from which I have obtained eggs in confinement, later than May, and all those which I have noticed as they were ovipositing in natural state, have been fresh colored, and evidently not long from chrysalis; (I have witnessed similar phenomena in Ontario during the first part of July.) So I have no idea that this species differs in this respect from other butterflies. One brood of *D Archippus* succeeds another the season through, the females of each brood depositing their eggs within two or three weeks after emerging from chrysalis, and soon after dying; and the last brood of the year hibernates, the females not to be impregnated till the next spring." Which would be all correct, if we were dealing with a species that goes the round of its life's history in one locality, hibernating there in winter, and producing its kind in summer, year after year as so many do. But analogy fails us here; for we have to do with a species that requires the continent for a home, ranging from a defined northern limit on the one hand, to an undefined southern extension on the other, with no apparent attachment to

a locality but what suits its present needs; seemingly conscious of its being but a transient resident anywhere; chased from the north by the approach of winter, it is compelled by a necessity of its nature to return to it in the spring. Leaving the north in united multitudes in the autumn, it returns to it by independent units in the spring; and believing that there are several broods of it in the south, and that each of them is controlled by the same strong desire to travel, which at that season means northward; and that these will follow the same route as did the previous ones, depositing eggs where some had been laid before; I get an explanation for the comparative freshness of the butterflies that are late in arriving at the north, and in the great disparity in the size of caterpillars found on the milk-weeds during the season. But where to draw the line between north and south for them, I will not undertake.

PARASITES IN THE EGGS OF CHRYSOPA.

By J. Alston Moffat, London.

On the 19th of June, 1900, whilst strolling in Victoria Park, London, my attention was arrested by an unusual looking object on the underside of a linden leaf, attached to a projecting branch a little above the level of my eyes. I plucked the leaf to closely examine it, but could not decide as to whether it was an animal or vegetable production. Afterwards remembering that I had seen an illustration somewhat resembling it, I turned it up, and found that singular object to be an egg cluster of the delicate lace-winged fly of the genus *Chrysopa*.

Fig. 8.

The Rev. J. G Wood, in Insects at Home, page 281, thus discoursed upon the eggs of this insect: "They are generally deposited upon leaves, but, instead of being laid directly on the leaf, every egg is fixed to the end of a slender footstalk about half an inch in length. This footstalk is formed from a viscous matter secreted by the female, and is delicately white and translucent. Mr A. G. Butler, of the British Museum, told me that he has kept lace winged flies, and often seen them lay their eggs. The end of the abdomen is first pressed against the leaf, and a tiny drop of the viscous matter deposited. The abdomen is then raised quickly so as to draw out a thread, which becomes stiff and hard almost as soon as it comes into contact with the air. Then the insect pauses a little, and rapidly places an egg on the end of the thread, fixing it there with another drop of the secretion. The eggs are always laid in groups. . . . They bear a curious resemblance to the capsules of certain mosses, and indeed have been described and figured in books as specimens of British moss". Which is not very surprising, as they instantly suggested a moss in fruit, but much more slender than any moss that I had seen.

There were thirty-four eggs in the cluster, and a single one placed on the upper side of the leaf. The eggs were about the thirtieth of an inch in length, and about as long again as they were wide. The stalks would bend to every breath, like a field of heavy laden grain before a breeze; giving the impression that they were top-heavy. I placed the leaf in a box and awaited developments. In a day or so the eggs changed colour, becoming darker, and I fancied larger. One morning on taking my accustomed view, some of the eggs had become white, and upon applying a lens I found they were empty, nothing but an extremely thin shell left with a hole in the top, out of which an insect had come. I then made diligent search to find them, when I at last discovered three tiny creatures in a depression of the leaf near the mid rib, as if they had therein sought safety and shelter. They were about three times as long as they were wide, and each armed with a pair of tremendous jaws which appeared to form quite one half their entire length; reminding me of the ant lion, to whom it is said to be related. That was my only view of them, for the next time I looked they had all disappeared. Having no Aphides to feed upon, probably the stronger devoured the weaker and then escaped from the box. Six of the eggs had matured and given forth their contents, whilst in the meantime the others had assumed a leaden hue. On the 28th of the month I was looking at them to see if there were symptoms of change, and wondering what might be the cause of their present

appearance, I observed a dark speck moving rapidly on the white paper with which the box was lined, and on examing with a lens I discovered it was a fly. It was honey-yellow in colour; its head was wide and squarish, with thorax of similar width, and abdomen tapering suddenly to a point. Its eyes were situated on the outer corners of its head, like those of a *Cicada*, dark colored and prominent. Its wings lay flat on its back, and projected half their length beyond the abdomen. It was very active, running rapidly and disappearing by flight every now and again, to reappear in another part of the box. I now turned my attention to the discolored eggs, and found several of them had holes in their sides out of which Ichneumons had escaped; and probably that fly was one of them. Upon making a closer examination all the discolored eggs had on their surface, what were in all probability Ichneumon eggs, and upon one of them I counted six. Clean-cut round holes out of which Ichneumons had escaped were found, variously located on some of the Chrysopa eggs, but in no instance had there more than one parasite matured in any one egg, and the great majority of them had not given forth any. There was abundant evidence to prove it a clear case of overdone parasitism, and that the most of the parasites had failed to mature from lack of sustenance. Many of the *Chrysopa* eggs exhibited several circular markings on their shells, as if they had been made on the inside preparatory for the escape of the fly, which had died before accomplishing it; whilst others shrunk and cracked upon drying.

A manifestation of this sort seems like a great waste of energy in nature, and a lack of intelligence on the part of the creature committing it, which is hardly in accord with the theories promulgated by some writers about the forethought exercised by forms of life, for the progress and improvement of their kind. In this instance we see merely a female ichneumon, constrained by the controlling impulse of her nature to deposit her eggs. Having found a cluster that answered her purpose, she fulfilled her mission regardless of consequences; and whilst she overlooked some of the eggs, she deposited far too many upon others, which came very near exterminating a whole brood of this useful insect; whilst at the same time she nearly extinguished the life of her own offspring. Therein giving us a fine illustration of how the works of nature are carried on under an established government by law; when each individual is strictly following the controlling impulses of its own nature, and yet is not prevented from taking a departure from routine in case of an emergency.

THE DRAGON-FLIES OF THE PROVINCE OF QUEBEC.

By Rev. T. W. Fyles, D.C.L., F.L.S.

Among the most beautiful of the insect tribes are the dragon-flies. The imposing size of many of the species, the brilliant colouring of their eyes and bodies, their wide-spreading, closely-reticulated wings, the rapidity of their flight, the dash and *elan* of their approach, the rustle of their wings as they sweep around, fill the intruder upon their haunts with admiration.

This admiration is increased when an opportunity is afforded for a close examination of one of these remarkable objects. The head of the insect seems to be made up mainly of eyes and mouth. The innumerable facets of the protruding, compound eyes glow with prismatic hues. In Æschnidæ and Libellulidæ these eyes are contiguous, and there is but a very small space between them and the mouth organs; but in this small space there are three ocelli or single eyes. The dragon fly can see above and below, behind and before. It detects every motion of its enemy or its prey, and its powers of flight enable it to escape from an assailant and overtake a fugitive.

The mouth of the dragon-fly is furnished with two large flat lips, which work up and down, and enclose the mandibles and maxillæ like a visor. When the creature is feeding this motion of the lips would lead one to think that the jaws move vertically, instead of horizontally, as is really the case.

Besides its powers of sight and its formidable mouth-organs, the dragon-fly has an advantage which many other insects have not—its head moves freely on its neck. It can turn its head half way round. Woe to the unhappy insect that comes in the way of so formidable a spoiler!

The thorax of the dragon-fly is capacious and somewhat barrel-shaped. It contains

the powerful muscles necessary to move and control the four ample wings and the six legs of the creature.

The abdomen extends far behind, to steady the insect, and to aid in steering its flight; but in the Libellulidæ it is somewhat flattened and ends with a point. In *Corduligaster* the cylindrical abdomen ends with a knob or swelling, hence the name, a club, a paunch. In *Gomphus* the abdomen is spatulate at the end.

July and August are the months in which the dragon-flies abound. Then every pool, every stream, is frequented by them. Sometimes the observer may see them in the act of depositing their eggs. They alight upon the flags, arrowheads and other aquatic plants, and taking suitable positions dip their abdomens into the water, and deposit their eggs in masses upon the stalks and leaves beneath the surface.

The embryos, in different stages of their growth, have been observed and figured, and the larvæ of various kinds are known. To the possessor of an aquarium the study of the habits of the dragon-fly, in its early stages, would afford great pleasure.

A dragon-fly larva is a wonderful thing. At first sight the uninstructed observer does not see much to admire in it, but closer examination reveals features of exceeding interest. One of these is the extraordinary under lip of the creature, which takes the form of a jointed arm, furnished at the extremity with nippers for securing its prey. When not in use this instrument is neatly folded under the throat of the larva—it is called "the mask" (Fig 9). Then too, the peculiar arrangements by which the insect obtains oxygen, its vital breath, from the water, are worthy of notice. It has no head gills, as the fish has; no branchiæ like the larva of the Horned Corydalis; no breathing tube like that of the rat-tailed maggot of Eristalis. The respiratory organs lie within the abdomen, and the water is admitted to them through an orifice furnished with five angulated plates, which open or close as need requires. Ordinarily the process of the alternate admission and expulsion of the water goes on with easy regularity; but when the creature is alarmed or stimulated by the sight of its prey, the water within its body is expelled with sudden force, and the tiny current, impinging upon the inert volume around, sends the insect forward with a rush, as the rocket is sent through the air by the pressure of the gases suddenly generated by the combustion of the materials with which the case is filled.

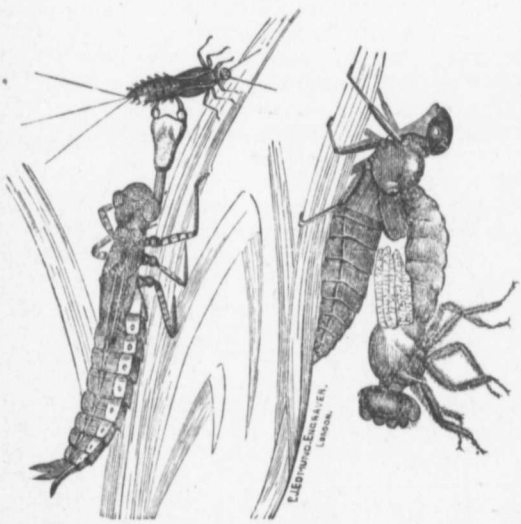


Fig. 9.—The left figure represents the larva with its protruded lip in the act of seizing its prey; the right shows the perfect insect emerging from its pupal case.

The metamorphoses of the dragon-fly are incomplete. At the pupal change the insect does not become quiescent, nor does it cease to feed—it retains its active habits and voracious appetite. When the time comes for it to assume the imago state, it climbs some plant or other object till it is clear above the surface, and then its skin bursts along the thorax and the perfect insect crawls out of the opening and leaves its old habit, attached by the claws, as a memorial of its former state. (See Fig. 9.)

Having thus introduced the Odonata, and given some glimpses of their habits, we will now notice their classification.

They are divided into four families: AGRIONIDÆ, GOMPHIDÆ, ÆSCHNIDÆ, and LIBELLULIDÆ. These are easily distinguished each from the others.

The Agrionidæ have the eyes wide apart and placed apparently on pedicels.

The Gomphidæ have large eyes, near together, *but not touching each other.*

The Æschnidæ and Libellulidæ have eyes that are contiguous. In the former *the labial palpi have three joints*; in the latter the joints of the labial palpi *number on* w

The following is a list of the Dragon flies accredited to the Province of Quebec:

AGRIONIDES.
- Calopteryx, Leach.
  - *Splendens*, Selys.
  - *Virginica*, Drury.
  - *Maculata*, Beauv.
- Lestes, Leach.
  - *Unguiculata*, Hagen.
- Agrion, Fab.
  - *Hageni*, Walsh.
  - *Ramburii*, Selys.
  - *Iners*, Hagen.
  - *Positum*, Hagen.
  - *Saucium*, Burm.
  - *Civile*, Hagen.
  - *Durum*, Hagen.

GOMPHIDES.
- Gomphus, Leach.
  - *Vastus*, Walsh.
  - *Fluvialis*, Walsh.
  - *Fraternus*, Say.
  - *Exilis*, Selys.
  - *Spinosus*, Selys.
  - *Rupensulensis*, Walsh.
  - *Colubrinus*, Selys.
- Corduligaster, Leach.
  - *Lateralis*, Scudder.
  - *Obliquus*, Say.
- Petalura, Leach.
  - *Thoreyi*, Hagen.

ÆSCHNIDES.
- Anax, Leach.
  - *Junius*, Drury.
- Æschna, Fab.
  - *Constricta*, Say.
  - *Vinosa*, Say.
  - *Verticalis*, Hagen.
  - *Heros*, Fabr.
  - *Janata*, Say.
  - *Septentrionalis*, Ramb.

LIBELLULIDES.
- Macromia, Ramb.
  - *Transversa*, Say.
  - *Illinoisensis*, Walsh.
- Epitheca, Charp.
  - *Yamaskanensis*, Prov.
  - *Forcipata*, Scudder.
  - *Princeps*, H gen.
  - *Elongata*, Scudder.
  - *Albicincta*, Burm.
  - *Linearis*, Hagen.
- Cordulia, Leach.
  - *Uhleri*, Selys.
  - *Lateralis*, Burm.
- Plathemis, Hagen.
  - *Trimaculata*, De Geer.
  - *Subornata*, Hagen.
- Libellula, Linneus.
  - *Quadrimacula*, Linn.
  - *Pulchella*, Drury.
  - *Exusta*, Say.
- Diplax, Charp.
  - *Rubicundula*, Say.
  - *Scotica*, Donovan.
  - *Hudsonica*, Selys.
  - *Intacta*, Hagen.

Many of these species are reported to have been taken on the Yamaska River.

Space would fail me to give particulars of all these species. Their acquaintance can be made by degrees. But a few words on the appearances of some of the most common and most noteworthy species may be acceptable.

First then, the beautiful "Demoiselles" (as the French call them) will be readily brought to mind. They may be found, in their season, on the banks of all our streams, and they are particularly abundant along the brook that crosses the road at St. David. These insects of the genus Calopteryx have wide-spreading equal wings, and long, slender, stainy and deep green bodies.

Much smaller, but equally beautiful, are the various species of Agrion. They frequent our quiet pools, and flit with ease and grace, from tuft to tuft of the herbage that abounds in their favourite haunts. *A. saucium* is bright red, like sealing wax. *A. civile* is a beautiful blue—one might fancy that it was a thread fallen from the mantle of the summer sky.

One of our most common dragon-flies is *Gomphus vastus*. It may be known by its black and yellow livery, and by the remarkable widening out of the three abdominal segments immediately before the last. This species abounds in the woods around Fort No. 2, Levis. I have no doubt that its larvæ may be found in "Mer de-Papon" and other pools in that neighbourhood.

The Æschnidæ are large and handsome insects. The rarest of them in these parts is *Anax junius*. I saw a pair of these sporting over a sheet of water near Spruce cliff last season, but they were careful never to come within reach. Æschna septentrionalis is often met with. It is that large black and bright blue dragon-fly with hyaline wings of a faintly green cast—the stigmata being long and brown. I always look upon this as the typical dragon-fly, "the Devil's darning-needle, the "Horse-stinger" so dreaded by children. I need not say that it is quite incapable of injuring either horse or man.

The species of the genus Libellula are all handsome insects. Their abdomens are dagger shaped, ridged down the middle, sloping to an edge on either side and pointed at the extremity. The female of *Trimaculata* has three brown patches on each of its wings —one patch at the base, one in the centre, and one at the tip. The spaces between are clear. The male (Fig. 10) has a patch at the base of each wing, but the tip of each is clear, and there is a large brown patch in the centre extending from the costa to the inner margin. The abdomen of the male is of a bluish white, as if it had been painted. A much larger and more beautiful insect is *Pulchella*. This also has three patches on each wing, but of a richer brown than in the last instance, and the spaces between the patches are clear white. *Quadrimaculata* is another very beautiful insect in this genus. It may be known by the golden yellow streak, and the two rich brown spots on each wing, and the angulated patch at the base of the secondaries. The abdomen of this handsome insect is brown, and has a row of yellow spots on either side. Quadrimaculata is found in Europe as well as in America. It was named by Linneus. It is very plentiful at the "Gomin." It breeds, no doubt, in the pools that lie to the south of the swamp.

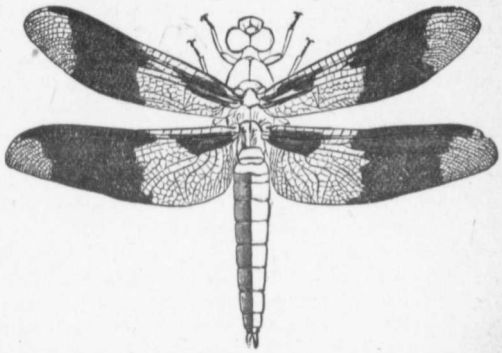


Fig. 10.

Of the genus Diplax, *rubicundula* seems the most common of our species. It abounds on the Chaudiere River. Insects of this genus may be readily known by their smaller size, their awl-shaped abdomens, and the very distinct stigmata of their hyaline wings. (Fig. 11 is the male of Diplax Berenice; Fig. 12 the female; Fig. 13 Diplax Elisa).

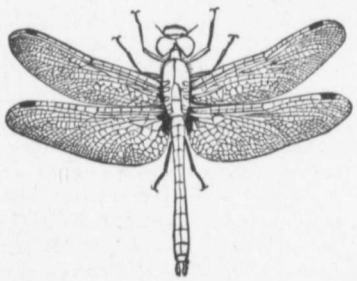


Fig. 11.

Fig. 12.

And now it may be asked, what useful purpose do the dragon-flies serve in the economy of Nature? We will take the liberty of meeting this question with one or two more. Did you ever go into the woods when the mosquitos were in strength, and thirsty for blood? Did you ever sail on one of our rivers —the Ottawa for example—when the shad-flies covered every inch above the tide of the vessel you were in? If you have, you will have said to yourself, if not to others, what a nuisance these things are! Now the dragon-fly spends the whole of its existence in the endeavour to keep down the numbers of such pests as these. It is a sportsman ever on the watch for its game, and when this comes in view it pursues it with energy and success. If it were not for the dragon-flies and other predacious tribes the troublesome insects would increase to an intolerable extent.

Fig. 13.

THURSDAY, NOVEMBER 15TH, 1900.

The Entomological Society resumed its sessions at 11 a.m, the President, Rev. Dr. Fyles, in the chair. After the reading of a paper by Mr. Henry H. Lyman, of Montreal, on "Specimens of Spilosoma Congrua, Walker, and kindred species in the British Museum," the meeting proceeded to the election of officers for the ensuing year, which resulted as on page two.

A number of papers were then read, followed by brief discussions in each case. After an intermission for lunch the meeting continued till five o'clock p.m., when the members from a distance left to catch their respective trains. Votes of thanks were adopted to Dr. Fletcher, Mr. H. Hague Harrington, and Mr. C. H. Young, of Ottawa, for their kind donations of rare specimens to the society's collection. Letters of apology for non-attendance were received from Dr. Wm. Saunders and Mr. Harrington, Ottawa; Mr. J. D. Evans, Trenton, and Mr. D. G. Cox, Toronto.

A large case of rare Lepidoptera was exhibited by Dr. Fletcher, special mention being made of many of the specimens. These had all been taken in Canada, mostly during the past year, and those of which special mention was made are the following:

Papilio Brucei. A specimen of this rare butterfly was taken at Regina by Mr. T. N. Willing, and along side of it was shown a bred specimen which Dr. Fletcher received from Mr. W H. Edwards. This Dr. Fletcher believed to be the first record of this insect having been taken in Canada, although it is mentioned in a list received from Mr. J. W. Cockle, of insects he has taken at Kaslo in the Kootenay mountains.

Vanessa Californica. Some beautiful bred specimens were exhibited, pupæ of which had been sent from Kaslo by Mr. Cockle. This is a seasonal insect which is usually rare but occasionally very abundant.

Attacus Ceanothi. A specimen of the moth bred from cocoons received from Mr. E. W. Haines, who formerly took a female at New Westminster, B.C. and has since bred two broods of the species in confinement in England. A fine series of inflated larvae showing every stage was also exhibited.

Memythrus (Sciapteron) *tricinctus* bred from cotton-wood twigs sent from Cotton-wood, N W.T.

A fine series of Arctians, including a beautiful series of *Arctia phalerata* with inflated larvae in all stages, which were described in full in a paper by Mr. Arthur Gibson, *A. Caja*, var *Americana*, *parthenos*, *Parthenice*, *Yarrowi*, from Hudson Bay, *determinata*, *vittata*, *Anna*, *figurata*, *Williamsi*, *Blakei*, etc, were shown.

Colias Eurytheme. Some interesting specimens of this species showing all the recognized forms and all collected at Ottawa, were shown. This has been one of the characteristic insects of the year and has been unusually abundant throughout Ontario.

Terias Lisa. A nice female taken at Ottawa by Mr. Gibson on the 18th Oct

Pseudolimacodes littera. A fine specimen of this pretty little moth, also taken at Ottawa by Mr. Gibson was shown.

Thecla Damon. A specimen taken at Picton on the 24th May last, by Dr. Fletcher.

Pieris rapae. An interesting series showing many variations was exhibited, including the buff female, and the very rare yellow female, the variety *novangliae.* The males of this variety are not uncommon, but the female is extremely rare. Dr. Scudder mentions that Curtis took a yellow female in England many years ago, and there are doubtless others but they are not recorded. Taken at Ottawa by Mr. Gibson, 18th Sept.

Peridroma saucia and *Noctua C. nigrum.* These were the two devastating cut-worms of the year. The former throughout the Province of British Columbia and the latter in Central Ontario. Beautifully inflated larvae in the last two or three stages were exhibited, with the moths

Pamphila Zabulon and *P. Hobomok* were shown in both sexes and the differences pointed out. It was claimed that these were distinct species and that *Hobomok* was probably the only one that occurred in Canada. The members were asked to be on the lookout for specimens of *Hobomok* which had not the veins darkened where they crossed the yellow colour of the disc. If they found one it would probably be the true *Zabulon.* *Zabulon* has no yellow female, but *Hobomok* has both a yellow female and a black female variety, which is called *Pocohontas.*

Euptoieta claudia bred from violets from Kinistino, N.W.T. Butterfly, larva, and pupa.

Pyrameis carye, butterfly pupa and larva. The larvae of this species were found by Mr T. N. Willing feeding on Nettle at Regina.

Cacœcia parallela. Larva, pupa and moths. A troublesome pest in a greenhouse at Hamilton.

Anacampsis lupinella. A new species of tineid bred from lupin collected at Toronto. Larva, pupa and moths.

The following specimens of insects were kindly presented to the Society by Dr. Fletcher:

Vanessa Californica,
Plusia rectangulum,
Plusia mortuorum,
Xylina contenta,
Lithomia germana,
Arctia phalerata,
Culex pungens,
Culex stimulans,
Anopheles quadrimaculatus,
Anopheles punctipennis,
Anthophilax malachiticus,
Arctia Williamsi.

A beautiful collection of inflated larvae was exhibited by Mr. Gibson. These had been collected during the past summer and showed several of the species in all their moults.

A fine case of rare moths taken at Ottawa was sent for exhibition by Mr. C. H. Young, of Ottawa, who kindly presented the Society with a beautiful pair of *Plusia aereoides*.

A box containing twelve species of rare *Proctotrypidae* not in the collection of the Society was presented by Mr. W. H. Harrington, of Ottawa.

THE SILKWORM INDUSTRY IN ONTARIO.

By Prof. W. Lochhead, Ontario Agricultural College, Guelph.

The purpose of this article is to answer the question: Is a silkworm industry possible in Ontario? This question has been asked frequently during the past season, and invariably by persons residing in the county of Essex. The question is a very important one, for if the conditions be favourable for the establishment of such an industry considerable additional revenue will soon flow into the county, and enrich those engaged in the industry.

The various factors bearing on the successful establishment of a silkworm industry will be briefly considered.

During the past season Rev. W. M. Fleming, of Essex, reared a large number of silkworms from eggs, and had remarkable success in the production of silk cocoons. So gratified was he with his success that he naturally began to ask himself the question: Why cannot a silkworm industry be established in this country? In letters to the Department of Agriculture he advocated the breeding of silkworms as an industry which might be carried on very profitably by persons in poor circumstances, who had no regular employment, where the women and children could attend to the feeding and care of the worms.

The writer had occasion recently to visit Essex, when he made a point of inquiring into the silkworm conditions of the locality. Several prominent persons of business persuaded by the success of Mr. Fleming were of the opinion that cocoons could be produced in paying quantities, and were anxious to try further experiments next season. Moreover, many persons, uninformed as to the market conditions, felt that the Government should start a series of experiments to determine the feasibility of the whole project, and give aid in the form of a bonus.

The conditions necessary for profitable production of raw silk are: 1. Cheap labor, and many laborers. The chief silk-producing countries are those bordering on the Medi-

terranean, and in the far East where labor is very cheap. Experience, moreover, has shown that many laborers are required to provide food for the silk worms during the last ten days, just prior to the spinning of the cocoons. 2. Suitable food-plants upon which the worms may live and grow. The mulberry leaves are the staple article of diet in Europe and Asia, but in the United States it has been shown that the leaves of osage orange form just as good a diet as the leaves of mulberry. 3. Suitable climatic conditions of temperature and moisture. Experience again has shown that the silkworms may grow well in many countries, and slight changes of temperature do not affect their well being to any appreciable extent, although of course they thrive best in warm, semi-tropical countries. 4. A ready market for the cocoons, or rather the reeled silk. Here again the cheaper labor of the Old World tells against the development of silk industry in this country, and to sell the reeled silk in France or Italy means such a great reduction in profits that our people could not compete.

On inquiry in Essex regarding the extent to which the county could fulfil the foregoing conditions, the writer learned that the labour was to be done chiefly by the women and children, and only during the last few days would extra help be required. Skilled help would be secured at this critical period, for many factors enter into operation during the last few days which are of vital importance in successful rearing. The worms are ravenous, and the amount of food consumed is simply marvellous. Fresh leaves must be secured and given regularly so that the worms may feed continously. When the food-plants are not close by, the task of feeding many thousands of worms becomes too heavy for women and children, and extra help must be obtained. Again, the worms must be carefully watched at the time of spinning the cocoons to prevent two worms forming one united cocoon, as is often the case where the worms are kept too crowded Then, again, the cocoons must be secured and the enclosed pupae killed within the cocoons. The best method of killing the pupae is to place the cocoons in an oven heated to about 194 degrees F. All this work involves care, and if the silk growers procure their own supplies of silkworm eggs for the following season some additional care is necessary. The moths are allowed to escape from the cocoons which they usually do about two weeks after the spining of the cocoons.

Essex county is fortunate in having a mild climate, one in which the mulberry and osage orange trees grow quite readily. Both the Russian and the native species are common, and two or three years would suffice to grow mulberry trees of such a size as to feed the silkworms of a large industry. Osage orange trees, too, are very abundant, and miles of hedges can be seen by driving along the roads of central Essex.

Through the kindness of Director Stupart, of the Meteorological Office, Toronto, the writer is able to give a comparison of mean temperatures of Essex county and Central France, the great silk-producing region of France. The mean temperatures for the months of April, May, June, and July are given below :

	Claremont, France.	Moulins, France.	Windsor, Ontario.
April	51.1	50.0	45.7
May	56.1	56.8	58.0
June	62.2	63.1	67.7
July	66.6	67.6	68.5

During the last week of May and the whole of June the silkworms are feeding, and by the first week of July the cocoons have been spun. From the table presented above it will be seen that the temperature of Essex differs but a little from that of Central France during the critical period.

The practical experiments carried on by the United States Department of Agriculture from 1884 to 1891 show conclusively that a most excellent quality of silkworm cocoons could be raised over most of the United States; and Dr. Howard, U. S. Entomologist, states as his opinion that the silkworm could without doubt be grown successfully in lower Ontario ; but the absence of a home market for the cocoons puts the industry for the present out of the region of possibility. There are no establishments in the United States for reeling silk from the cocoons. No person could be induced to start reeling establishments for the reason that "no silk reeler could afford to pay a price for cocoons which would induce even the poorest of our citizens (or even non-producing mem-

bers of the family) to undertake the more or less arduous labors of raising worms. It was found impossible to convert the cocoons into raw silk, namely, to reel them in this country in competition with the cheap labor in foreign silk-producing countries."

In 1890 it was shown that even with the introduction of improved automatic, electric silk-reels it was impossible to compete with Europe and Asia without the imposition of a customs duty of not less than $1 per pound on reeled silk imported into the United States.

A few facts regarding the weight of silk-moth eggs and cocoons may be interesting to persons who intend experimenting with silkworms. One ounce of eggs contains about 40,000 eggs (in France a family usually undertakes to rear this quantity). From these are obtained from 80 to 120 pounds of cocoons, which yield from 11 to 17 pounds of reeled silk. About 300 medium-sized cocoons weigh one pound, while the silk reeled from these weighs about one-eighth of a pound. In other words, 2,500 medium-sized cocoons will yield one pound of reeled silk.

The life-history of the silkworm (*Bombyx mori*) is very instructive and interesting. Each female moth lays nearly 500 eggs in a cluster soon after she emerges from the cocoon about the first or second week in July. The fertilized eggs are drab-colored, while the unfertilized ones are white or grey. The young worm on its first appearance is nearly black, covered with stiff hairs, and is about one-eighth of an inch in length. It becomes full grown in about twenty-eight days, during which time it has moulted four times, becoming lighter in color with every moult. When mature it is creamy white, has a prominent projection on the dorsal surface near the end of the abdomen, and is two or three inches long. The spinning of the cocoon occupies nearly three days. The threads of silk are viscid for a few days and consist of two fibres secreted by two glands which run along the sides of the body and open together on the under lip of the worm. This double thread is said to be about 4,000 yards in length.

The pupa moults once within the cocoon, the skin of the first moult usually remaining attached to the inner surface of the cocoon. The color of the cocoon may be white, or yellow, or orange, and investigations fail to reveal the cause of the variation in color. In four or five days after the cocoon is made the silk is ripe, when the pupa may be killed by heating the cocoon to a temperature of 194 degrees F. in an oven as already mentioned. If the moth is allowed to escape one end of the cocoon is broken, thereby injuring the continuity and excellence of the silk threads.

The moth is whitish or cream-colored; its fore-wings are falcate, with one or two brownish lines crossing the wing. The moths are not inclined to fly much, and are easily kept in confinement until the eggs are laid. There is but one brood a year, but the greater part of the year is spent in the egg state. The active period covers little more than six weeks, of which four weeks are spent as worms.

Concluding, the present market condition for reeled silk precludes the possibility of the establishment of a silkworm industry in Ontario, and "serious disappointment will surely follow exaggerated ideas upon the subject of silk-raising for profit, and if any person is contemplating such a course he is very strongly dissuaded therefrom."

Dr. Fletcher spoke of the interesting character of the paper and said that the Government at Washington had given up its experiments with silkworms because the French manufacturers would not pay for the cocoons a price that would remunerate American labor. In France they kept the eggs in a cool place so that they might not hatch till the mulberry trees were in leaf; if they should hatch too soon they could be fed upon lettuce, but this food was not safe, as it often produced diarrhœa in the caterpillars. He referred to the fact that most schoolboys in England reared silkworms for amusement, and in consequence a very large number became deeply interested in entomology.

RESULTS OF SOME APPLICATIONS OF CRUDE PETROLEUM TO ORCHARD TREES.

By F. M. Webster, Wooster, O.

The varying and sometimes disastrous results obtained from the use of refined petroleum, on growing trees, as an insecticide, and especially against the San José scale, has led to the suspicion that the crude product might be less variable and drastic in its effects.

But so far as it has been used it would appear that we have yet much to learn, before we can, with safety, recommend the application of the crude product to the different varieties of fruit trees. That it is efficient in destroying the San José scale, if it is brought in contact with this insect, seems now quite probable. But the hundreds of dead trees that mark the areas where it has been indiscriminately used, point very clearly to the fact that great caution is necessary, and no one is, as yet, able to say just where safety ceases and danger begins Then, too, when no permanent injury is apparent, as in the case of the seedling apples on the grounds of the Ohio Agricultural Experiment Station, at Wooster, Ohio, who can say that this unnatural retardation may not, after the first application prove to be a menace to the life or general vigor of the trees? It is well known that, in nature, these retardations sometimes occur, but nature seldom, or never, covers the bark of a tree or a shrub, and then only in part, with vegetable growths like lichens, and even these are known to be detrimental, a smooth, clean bark being always desirable.

In the use of refined petroleum, one of the most perplexing phenomena observed was the fact that, equally careful applications, made by the same person, with the same grade of oil, would give almost opposite results. Hence, recommendation of the refined product for general use has, in many cases, resulted disastrously and brought no little disrepute to the entomological fraternity of this country. The most that can now be said for the refined product is that a ten to twenty per cent mixture with water constitutes a fairly successful summer wash and destroys the young scale, thereby checking the increase and spread until applications of whale oil soap mixtures can be made.

In the use of the crude product, I have seen some of the most astonishing results obtained, but, as with the refined, I have seen also the most disastrous effects. Perhaps the uncertainty of effects in using crude petroleum in the orchard may be best illustrated by giving the results obtained, this year, by Mr. N. A. Hadden, of Catawba Island. Mr. Hadden used crude petroleum on the strength of recommendations from New Jersey, including those published by Prof. John B. Smith, and contrary to the advice of some of his neighbors. As I knew nothing of the matter until some weeks after the latest applications, nothing could have been said or done by me to in any manner influence Mr. Hadden, who followed his own course, and, I may add, has offered me every facility for observing the final results.

About 50 peach trees of the Crawford's late variety were sprayed March 10, 1900, with 100 per cent crude petroleum from an oil well near Gypsum, Ottawa County: Distillation B. The spraying was carefully done and none of the petroleum was allowed to run down the trunks of the trees. The effect on these trees was to kill every one of them. Two other blocks of peach trees on which crude petroleum from the same well was used, were also totally destroyed. On the same day, March 10, 1900, six plum and one peach tree were sprayed with crude petroleum from the same well and of same strength. Two unhealthy plum trees died; the other four were uninjured, as was also the peach, which not only made a vigorous growth but bore several peaches. Several rows of Smock and Salway peaches were sprayed April 7th with 100 per cent. crude petroleum, and, though not showing serious injury on May 16th, in July 90 per cent were dead and the remainder fatally injured. Crawford's Late, sprayed March 8th with 10 per cent. crude petroleum, and another block sprayed with a 40 per cent. mixture, were not seemingly injured, but bore no fruit. Eight apple trees and several peach trees, sprayed March 8th with 10 per cent. crude petroleum, were uninjured.

On the premises of C. W. Shoemaker, at Waterville, Ohio, there stands a Wilder Early pear tree, that for several years was badly affected with the Scurfy Bark louse. The tree was stunted and made little growth each year. Two or three years prior to 1900 the tree was sprayed in spring with kerosene emulsion, which killed many of the insects, and the tree afterwards made a better growth than it had previously done. April 2nd, 1900, this tree was painted with crude petroleum, the analysis of which I have not been able to secure On August 17th, 1900, I saw the tree, and the bark still gave good evidence, by its colour and shining appearance, of the presence of the petroleum. The growth has been vigorous and the foliage was of the most healthy colour. The Bark-louse seemed to have been quite exterminated.

On March 23rd, 1900, a row of three year old seedling apple trees, on the Station grounds near Wooster, was treated with crude petroleum of different strengths, applied with a Deming kerosene attachment, the applications being made by two of my assist

ants, Messrs. Newell and Roudebush. This petroleum was taken directly from oil wells at Lodi, Southern Medina county and its chemical composition is shown in "analysis A." Different trees were sprayed with different strengths of the oil, varying from 10 per cent. crude pretroleum and 90 per cent. water, up to 100 per cent. crude petroleum. In no instance were the trees permanently injured. The effect was simply to retard the development of the foliage, until about the middle of May. May 7, many varieties of apples were in full bloom. The Winesap and Rome Beauty were showing their first unfolding blossoms. Strangely enough, the effect was rather more marked where the 10 per cent. solution was used. Where we used the 40 per cent. the retardation was less than where we used the 20 and 50 per cent. crude petroleum; the effect of the 40 per cent. being about the same as the 100 per cent. The 30 per cent. was almost the same in its effects as the 10 and 100 per cent. mixtures. June 13th, an examination of the trees showed that the normal amount of foliage had been put forth, and the leaves were exceedingly healthy in appearance and seemed larger than those on the unsprayed trees. An examination of the trees the middle of October showed that the first sprayed trees were really holding their foliage better than the unsprayed. Nearly all of the leaves had dropped from the latter while scarcely any had fallen from the sprayed trees. The tree sprayed with the 100 per cent. crude petroleum seemed to have held its foliage better, and the colour was more fresh and vigorous than on those sprayed with the diluted petroleum.

While all this indicates that crude petroleum may be used once upon apple with a strong probability of no detrimental results occurring from its use, nevertheless, the question is yet to be settled as to whether one or more additional applications will result in the same way. It seems to me that this whole matter has not yet reached the point where we will be justified in saying to the public it will be safe to use the crude petroleum. The practical question is not whether an expert can use this as an insecticide with safety, but whether it can be safely trusted in the hands of inexperienced men who are not trained in exactness of methods or quantities. I do not wish to be understood as in the least denying that there may be something in both crude and refined petroleum that may, in the future, have great value as an insecticide, but that, for the present, we should be content with investigations, and be exceedingly cautious in regard to recommendations until we have at least found out the reason for such widely diverse results being obtained from applications so nearly alike in point of materials and methods.

It must be remembered that our experiments with crude petroleum at Wooster, Ohio, were made upon seedling apple trees, which, though they might have possessed different degrees of resistibility, might, on the other hand, have been less susceptible than any of the grafted varieties. The selection of these trees was not a matter of choice, for they were the only ones available at the time. Next year, we shall endeavour to reverse the experiment; that is, where the 10 per cent. mixture was used this year we shall use 100 per cent. next year, and vice versa. A large number of experiments are also to be carried out upon different varieties of apple, in different parts of the State, using different strengths of the crude petroleum.

PETROLEUM DISTILLATIONS.

	A	B
Specific Gravity	35°B	34°B
Light Naptha, 80°C	1.49%	.14%
Heavy " 80° to 120°C	4 35	1.63
Benzine, 120° to 150°C	5 03	3 82
Light burning oil, 150° to 200°C	7.64	13 48
Heavy burning oil, 200° to 250°C	13 54	12 03
Residue from 250° Dist	68.70	68.62
	100.74%	99.72

A, from Lodi, Ohio, well. B, from Gypsum, Ohio.
Distillations by J. W. Ames, Asst. Chemist, O.A.E S.
B contains sulphur compounds.

INJURIOUS INSECTS IN ONTARIO DURING 1900.

By Dr. James Fletcher, Dominion Entomologist, Ottawa.

The practical entomologist has had his hands full during the past season in Ontario. The season has been a most unusual one—hot and dry in some sections, but unusually wet in others. There have not been, however, any very remarkable outbreaks of injurious insects which have been the cause of widespread loss; but some of the old and well known pests have done a considerable amount of harm, much of which could have been prevented if farmers would only recognize that they have every year to reckon with the generally forgotten but always present tax collectors belonging to the insect world and that these always work in the same way. Orchard insects, which could have been controlled by spraying, were neglected in many places, and Cutworms caused losses which could have been prevented. The Pea Weevil, every year abundant and destructive, seems this year to have been more so than usual, but the Destructive Pea Aphis was not so injurious as at one time it was feared it would be. Late in the season it was found that great harm was being done by the Hessian Fly throughout western Ontario, most particularly in early sown wheat. The Turnip Aphis was only locally prevalent. The San José Scale has spread over many orchards which were only slightly affected in the beginning of the season. The so-called Buffalo Moth is becoming a serious pest and is spreading.

Cereals.

By far the most serious outbreak among cereals was by the Hessian Fly (*Cecidomyia destructor*, Say, Fig 14, highly magnified) in fall wheat. Specimens of young wheat plants infested to a remarkable degree, some of the shoots containing nearly a dozen puparia, were received from Waterford, Ferguson, and other places. Very few reports of injury by the summer brood came to hand, so that this sudden appearance of the insect in such large numbers was somewhat of a surprise. Reports from correspondents show that late sown grain was to a marked degree less infested than that sown at the usual time in the beginning of September. The appearance of the perfect insects,—tiny blackish gnats not expanding more than a quarter of an inch from tip to tip of the outspread wings,—and the life history are so well known that it is not necessary again to go into details here with regard to these; suffice it to say that there are two broods in the year, the perfect flies of the first appearing in May and June, and laying their eggs on the leaves of the growing wheat plant. The small maggots work their way down inside the sheaths of the leaves and attack the tissues of the growing stem, weakening it and frequently causing it to fall down, bending over just above the point of attack. The brown flax-seed-like puparia may frequently be found in straw or under the machine at the time of threshing Some of these flax seeds the number varying according to the season, produce the flies the same autumn, chiefly in the month of September; these lay their eggs on the newly sown fall wheat. Some of the flies of the summer brood, however, do not emerge until the following spring—at the same time as the flies of the autumn brood—and these lay their eggs on the young plants of spring wheat. This attack is frequently overlooked, owing to the fact that, if the wheat plants are not sufficiently advanced for the eggs to be laid upon the stem leaves, they are laid upon leaves close to the ground and the larvæ attack the root shoots and kill them before they have produced stems at all. I find that, as a general thing, there is a great deal more injury done in this way than on the stems of wheat. Farmers, as a rule with this attack, do not recognize their enemy and attribute the thin crop to "cold or wet springs," "late frosts," "hot suns," or other imaginary causes of which no exact record had been kept. As stated above, there is this autumn a very serious attack by the Hessian Fly in our Ontario wheat fields, particularly in those sections where fall wheat is most largely grown. As a matter of fact, fall wheat can be grown in every county of the Province, and the Hessian Fly is liable to occur in any of these. Certain areas, however, from the

Fig. 14.—Hessian Fly.

satisfactory results are recognized to be particularly well suited for the cultivation of this cereal.

Many experiments by agriculturists have shown that better crops are reaped if the seed is sown early, that is, about the 1st of September. This, however, is only true in such years as the Hessian Fly is not prevalent. Therefore, it is decidedly advisable for growers of fall wheat to remember in such periods as the Hessian Fly is abundant, what the life-history of this insect is, and, instead of trying to sow their fall wheat seed by the 1st of September, delay this operation until after the 20th, being content to get a slightly smaller yield and to be sure of it, than, in the effort to get a bigger crop, perhaps run the risk of losing half or even the whole from the attacks of the Hessian Fly. By postponing seeding until the end of September, the appearance of the young plants above the ground is delayed until after the egg-laying flies of the second brood are dead. Where fall wheat has been sown in August and is already well up, it is considered advisable when the Hessian Fly is known to be prevalent to feed off a good deal of the green top with sheep during the month of September, in which manner it is claimed that many of the eggs are destroyed. Care must be taken that the fields are not cropped too closely nor too late in the season. Late sowing therefore may be claimed to be the most important preventive remedy against the Hessian Fly. There are, however, other methods of reducing the numbers of this insect, among the more important of which are the treatment of stubble and the burning of refuse. The treatment of stubble is of most use in such districts as Manitoba, where there is only one brood of the Hessian Fly, which is restricted to spring-sown grain. In 1899 the Hessian Fly appeared for the first time in Manitoba, where no fall wheat is grown, and did an enormous amount of harm. Fortunately, this year there is no recurrence of this attack. The insect passes the winter in Manitoba, for the most part, in the stubble, although some of the puparia are carried from the field with the straw. Therefore, if stubbles be burnt over or ploughed down deeply in autumn and the straw is fed to stock or burnt at any time before the flies emerge in spring, there being no autumn brood, this pest should not be difficult to control. The burning of refuse which is thrown down beneath the threshing machine, will also dispose of many flax-seeds of the summer brood which did not emerge in the autumn and were carried in the straw. If this refuse were not destroyed, these would give forth their flies the following spring.

In cases where fields are found to be infested with Hessian Fly, it is sometimes difficult to decide what a farmer's wisest course is. If the infestation is only light, it is sometimes possible to stimulate the crop by the use of a light application of some quick acting fertilizer. Where, as is generally the case, there are patches in the field which have been destroyed, it is desirable to save such parts of the field as are uninjured. These patches can be sown in spring to some crop which will not require cultivation, e.g. an early ripening barley, which can be cut at the same time as the fall wheat and the whole threshed as mixed feed If, however, it is necessary to save the wheat separately, peas may be sown on these patches, which can either be cut after the wheat, or the grain can be separated after threshing. In cases of bad infestation it would sometimes pay better to use the land at once for some other crop.

The usual practice of simply cultivating deeply so as to produce a good seed bed is an improper one, because the flax seeds are present and, if the land is only cultivated, the flies will emerge in spring and prove a source of infestation to the uninjured remainder of the wheat crop and also to any spring wheat or barley which may be sown nearby. Infested areas should be ploughed down deeply so that the flies when they emerge from the flax seeds shall be unable to work their way out Then any crop may be sown except spring wheat. Barley and rye are also sometimes liable to attack; consequently, other crops are preferable to these, such as oats, peas, corn or roots There will sometimes be cases where the farmer is uncertain what it is best to do, owing to the occurence of uninjured patches in an otherwise badly infested field. In these cases it will be best to wait and see how the wheat will turn out. If at last something else has to be substituted as a crop, probably the best returns will be obtained by sowing early ripening corn where a cultivator can be used, or early peas where the patches are surrounded by wheat. Both of these crops may be sown as late even as the middle of June and will give good results. Mr. N. H. Crowley, a very careful observer,

of Waterford, Ont., has noticed that different varieties of wheat are not injured to the same extent; for instance, in one field of Clawson wheat about eighty per cent. of the plants contained Hessian Fly puparia, while Democrat wheat near at head was only injured to an extent of thirty per cent. Again, Clawson wheat was as a rule attacked in the upper and earlier sprout which was killed, but an uninjured sprout was growing from the seed. Democrat wheat, on the other hand, showed the original sprout uninjured or to a much less degree than the other variety, and the secondary shoot had not by the end of November so far been produced. Of the two fields the Democrat looked green and healthy, but the Clawson looked yellow and faded, and there was a great deal of rust on the leaves.

A yellow colour so often referred to by farmers as an indication of the presence of Hessian Fly is a sign by no means always to be relied on, for, as Professor Webster, of Ohio, has pointed out, infested plants are for a time of a brighter green and more stocky than those in a healthy condition. However, there are frequently in the autumn enough dead leaves and shoots to give the fields a brown and unhealthy appearance, and these together with leaves attacked by the fungous disease rust, which sometimes, as during the present autumn, is very abundant, may have been the cause of the appearance which is so often described as "yellow from Hessian Fly."

CUTWORMS IN GRAIN.—There have been reports from restricted localities chiefly in the western counties, of injury to grain fields by the larvæ of the amputating brocade moth (*Hadena arctica*, Bdv.) and other cutworms.

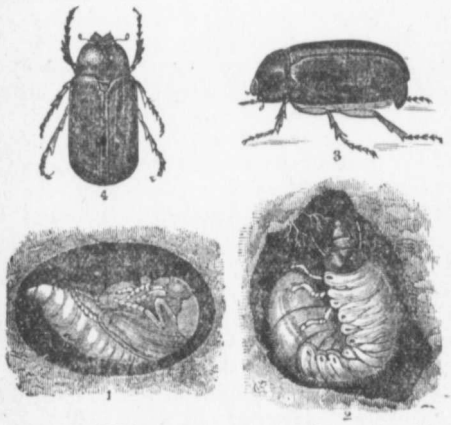


Fig. 15.—White grub: 1. pupa; 2. larva; 3 and 4. June beetle.

WIREWORMS are mentioned in several localities but no specimens have been sent in.

WHITE GRUBS. The larvæ of the June beetles (*Lachnosterna*), (Fig. 15, 3 and 4), have done a good deal of harm not only in pastures but to some field crops in different parts of the province. Notwithstanding the very different appearance of these two kinds of grubs, I find that they are very frequently confounded with each other by farmers. Wireworms (Fig. 19), the larvæ of the Click Beetles (Figs. 16, 17, 18), are slender cylindrical shaped, tough-skinned, bright yellow, grubs, about one inch long by one-eighth of an inch, or less, wide. The two ends of the body are somewhat similar in general appearance; Fig. 20 represents the pupa of a wireworm, upper and under side. White Grubs (Fig. 15, 2) on the other hand, are much larger, heavy-bodied, almost sack-shaped, white grubs with yellow heads having the end of the body enlarged, curved down and brown from their earthy contents showing through the thin skin. If the body were straightened, it would measure an inch and a half or more, by three-eighths of an inch wide at the widest part. The duration of the larval life of these two insects is probably about the same. The eggs of the June beetles are laid in spring, and the young grubs feed all the first summer and through the second one, attacking the roots of all kinds of plants, but being most numerous in fields where there are trees, or round the edges of fields near trees. By the end of the second summer they become full-grown and change to beetles, but do not emerge until the spring of the third year. Wireworms begin their lives much less regularly at any certain time of the year; the perfect beetles belong to a very large number of genera and species, which occur through the season, and the eggs

Fig. 16. Fig. 17. Fig. 18.

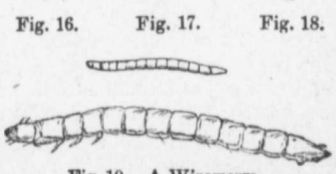


Fig. 19.—A Wireworm.

of some kinds may be laid at any time. The food of wireworms has a much larger range than is the case with the white grubs, many, and these are the most injurious species, feed upon the roots of grain and other crops, grass, shrubs and trees. Some feed on decaying wood and other vegetable matter, and some, at any rate occasionally, are even predaceous. On the whole, however, the class must be considered as decidedly injurious. In the beetle state Click-beetles (Fig. 21) are not considered very destructive but one species, *Corymbites tarsalis*, Melsh, has of late years been detected as a rather frequent enemy of the apple, feeding in the flowers and destroying the essential organs, and also eating the young foliage. As a general remedy for both of the above named classes of insects, late ploughing has been found beneficial, by breaking up the pupal cells at the time the insect is in a tender condition and exposing it to many dangers when it is either a pupa or an immature beetle, and unable to make another cell. The trapping of the mature Click-beetles by using pieces of potato poisoned with Paris green placed on the ground near where the beetles seem to be abundant is claimed by some experimenters to have been attended with considerable success. The June beetles are largely foliage eaters and are specially attracted to certain kinds of trees. Many may be destroyed by spraying these attractive trees with Paris green and lime, which may be applied as strongly as one pound of Paris green with two pounds of lime in 100 gallons of water.

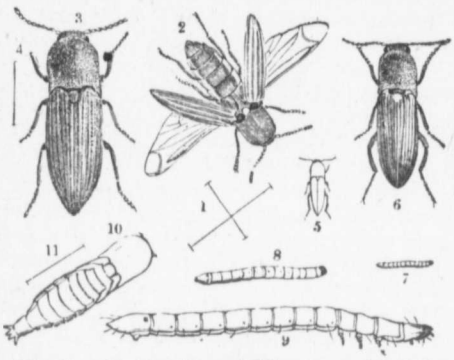


Fig. 21.—Click-beetles and Wireworms—2, 3, 6, 9, 11, magnified.

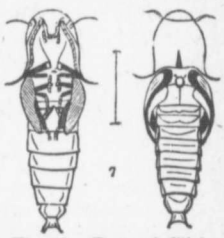


Fig. 20.—Pupa of Click-beetle.

The Pea Weevil (*Bruchus pisorum*, L., Fig 22).—Year after year, the loss in the pea crop from that old and well known enemy, the Pea Weevil, is simply appalling. The life history is well known and it must be claimed that the remedy is practical, that is, effective, cheap and easy, and yet it is not applied regularly by pea growers as it ought to be. As far as I can learn, the large seed merchants and the large growers do fumigate their pease with bisulphide of carbon and destroy the contained insects. The trouble seems to be with the small growers and farmers who save a few bushels for seed and do not take the trouble to treat these small quantities. As is well known, the Pea Weevil comes to maturity in autumn and if the season is favorable emerges at that time of the year and passes the winter under rubbish and in out-buildings. Many, however, remain in the pease and do not emerge until the following spring, when they are frequently sown with the seed. The perfect insects are very active little beetles which fly easily to the pea fields about the time the blossoms appear. They feed for some time on the flowers and leaves. As soon as the young pods are formed, the females lay their eggs upon them, from which the grubs hatch and eat their way into the pod and penetrate the forming seeds.

Fig 22.—Pea Weevil—greatly enlarged, and of natural size.

Remedies: The best remedies for this insect are the treatment of the seed with bisulphide of carbon, late sowing and the holding over of seed. Fumigating with bisulphide of carbon is the method now generally adopted by seed merchants and most of them have special houses for "bugging pease." Farmers can easily make use of this same method by taking an ordinary 45 gallon coal oil barrel which will hold five bushels of pease. According to the quantity of seed to be treated, one ounce of bisulphide is used to every 100 pounds of pease, that is three ounces if the barrel is filled. The chemical may be either placed in a flat open basin on the top, or it may be poured

directly on to the grain. The top of the barrel must be quickly replaced and covered up with cloths, etc., as tightly as possible. This treatment should be carried on in a shed out of doors, and the barrel must not be opened for 48 hours. Bisulphide of carbon is a colourless malodorous liquid which volatilizes readily at ordinary temperatures. The vapour is quite invisible, but being heavier than air it sinks readily and permeates the contents of the barrel. It is very inflammable and care must be taken when using it that no light of any kind is brought near. This treatment should be done in the autumn as soon as possible after the pease are threshed and before the weather has become cold. The sooner the treatment is done, the less injury the weevils will have done to the seeds, and, if the bisulphide is not used until cold weather has set in, its effect upon the insects is very much less than when they are in an active condition. Moreover, by delaying treatment there is the risk in mild autumns that the beetles may have attained full growth and left the seeds. The late sowing of peas is useful in preventing attack by weevil, but the method is not in favour with farmers because late sown peas in certain seasons are liable to be so much attacked by mildew as to reduce the crop sometimes more than would be done by the weevil. The holding over of pease until the second year, keeping them in close bags to prevent the escape of the beetles, is certainly a good remedy and is not practised by those who use small quantities of seed as much as it ought to be. The reduction of vitality of seed pease held over for one year is very little indeed. Unlike the Bean Weevil, the Pea Weevil cannot propagate in the dry seed so that every beetle which emerges dies inside the sacks. Before sowing, the injured seeds must be separated and only those which are perfect planted.

The Pea Moth (*Semasia nigricana*, Steph., Fig. 23).—In the eastern counties of Ontario and extending down through Quebec into the Maritime Provinces, much harm has been done by the caterpillars of the Pea Moth. They have been particularly abundant at Ottawa this year in late peas. As this insect resembles the Codling Moth very much in its methods of attack, some experiments were tried at my request by Mr. J. E Wetmore, of Clifton, N.B., by spraying the vines when the young pods were forming with a Paris green mixture which had been rendered adhesive by the addition of whale-oil soap. The results from these experiments, although not conclusive, are of a hopeful character and will form the basis of further experiments next year.

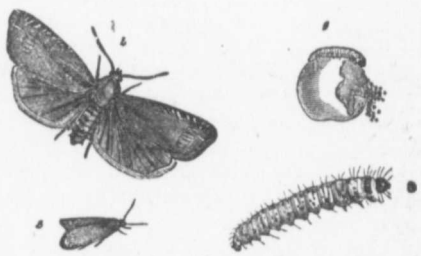


Fig. 23.—The Pea Moth—natural size and enlarged.

The Destructive Pea Aphis (*Nectarophora destructor*, Jnsn.).—This insect which was the cause of such extensive injury to the pea crop last year not only in the southern States but extending further north into Canada, has this year not been so bad as in 1899 but still has caused considerable loss. In the eastern counties the larger number of attacks have been noticed. The J. H. Allan Seed Company, of Picton, reports that "this season it has done considerable damage in New York State, Michigan and Wisconsin. Last season as well as this it caused injury in Prince Edward County as well as in Lennox and Addington. We are also told that it did much damage in Renfrew County." Last year in the State of Maryland the loss from this insect was put at $3,000,000, and during the past summer the loss in the same crop much exceeded that amount. Moreover, not only did this insect attack the pea crop but it was found to be much more distinctively an enemy of clover. This attack upon clover was not serious in Canada, and at Ottawa, where plots of peas were entirely destroyed by it, clover plots closely contiguous showed no sign of the presence of the aphis until very late in the season, when all peas had been killed by frost (November), and when a few were found. Many remedies were experimented with by Prof. Johnson, State Entomologist of Maryland, the describer of the species, and it was found that what has been called "the brush and cultivator method" was the most effective. For this it is necessary that the peas should be sowed in rows from 24 to 30 inches apart, and not broadcasted. He says, "The vines were brushed backward and forward with a good pine switch ahead of an Iron Age cultivator, which was drawn by one horse, and in this manner the insects which leave the vines freely when

these are shaken were covered up and a large proportion of them destroyed." The cultivation was not repeated until the third day, as it usually required 48 hours to destroy the insects when covered with earth. Another method which was tried with considerable success, consisted of a brush which dislodged the insects so that they fell into a pan containing coal oil and water, and dragged between the rows. In this way a bushel of plant lice were caught to each row of peas 125 rods long. Spraying was tested, but it was abandoned because no spray could be found which would destroy a large enough percentage of the insects to warrant the expense of the operation. An extensive experiment, however, covering 600 acres where the plants were brushed and cultivated every third day for a period of two weeks, forty men being employed, was very successful. In this manner the entire field was saved, netting the owner from 25,000 to 30,000 cases of peas of two dozen tins each. It is also stated that a field not far distant where nothing was done, was totally ruined. As is usually the case with all kinds of plant lice when they occur in excessive numbers, the Destructive Pea Aphis has been vigorously attacked by many kinds of parasites, which at Ottawa, at any rate, have had a remarkable effect in reducing its numbers Although the plant lice were extremely abundant in some places, they were almost totally wiped out on one or two occasions by certain of these enemies. The most useful parasite at Ottawa was a small dipterous fly, probably of the genus *Diplosis*. The small orange maggots of about a sixteenth of an inch in length crawled about among the colonies of plant lice and destroyed them in large numbers, piercing their bodies with their mouth parts and sucking out their juices in the same manner as is done by the larvæ of Syrphus flies. When full-grown these larvæ spin a small close cocoon either in the angles of the leaves or stem, or falling to the ground make a cocoon of silk with particles of sand attached. There were continuous broods of this useful parasite throughout the season, and the minute gray midges could be seen about the infested plants at all times. The last brood spun their cocoons in the middle of October, and the larvæ will remain in them until next spring. Several species of lady-bird beetles, Syrphus flies and lace-winged flies were also abundant, as well as species belonging to the hymenopterous genera *Praon* and *Aphidius*. The first of these emerges from its host and spins a cocoon beneath the dead body. The latter passes through all its stages inside the body of the plant-louse and when mature eats its way out through a circular hole.

Fodder Crops.

Fig. 24.—Clover Root-borer.

The Clover Root-borer (*Hylastinus obscurus*, Marsh=, Hylesinus trifolii, Muell., Fig. 24)—The Clover Root-borer generally occurs in a few localities in Canada every year, but is seldom the cause of much harm and this will be more and more the case not only with this species, but with the Large Clover Weevil (*Phytonomus punctatus*), as farmers get more into the way of sowing clover to a larger extent as a green fertilizer and plough it down after the first crop. During the past summer the Clover Root-borer was observed doing some harm in old fields of clover but also in some new ones right across the province. The worst occurrences were near London, at Picton and in a small patch at Ottawa. Clover which is infested flowers irregularly and the plants have an unhealthy appearance. The insect may be found in autumn in all stages in the roots of clover plants; the beetle comes to full growth late in autumn and remains in its burrows until the following spring. The remedy for this insect is a short rotation. The value of clover as a fertilizer is now so well known that farmers do not hesitate to plough down their meadows as soon as they find traces of this insect. This should be done as soon as there is a pretty good growth on the ground after the first crop of hay has been removed.

The Large Clover Weevil (*Phytonomus punctatus*, Fab.) was found to be abundant in the larval condition in a field, near Picton, Ont., which

was also infested by the Clover Root-borer. These larvæ, however, were almost all attacked by the fungus *Entomophthora phytonomi*, Arthur. Almost every blade of grass rising above the clover had at its tip a dead or moribund larva, and of a large number which were apparently healthy, collected for rearing, there was hardly a specimen which produced the beetle. The diseased grubs were of all sizes from very small to full-grown. This was on the 24th of May. A few of the full-grown larvæ taken at that time spun their lace-like cocoons in the beginning of June and two beetles emerged about the end of the month. The beetles measure over four-tenths of an inch in length, are oval in shape and of a brown colour with four pale punctured lines on the sides. The beak is rather short and blunt, the thorax smooth and swollen with three pale lines. The wing cases each bear ten deeply impressed lines of punctures, from which the species takes its name.

Roots and Vegetables.

A great number of insects have been complained of during the past season as having attacked more or less root crops and vegetables. Some of the more important of these are the following :

Cutworms —The Spotted Cutworm, as the larva of *Noctua C nigrum*, L, Fig. 25, has been inappropriately called, was extremely abundant in many localities along the north shore of Lake Ontario, injuring all kinds of garden and root crops. This is never a rare insect, but this year it was enormously abundant. The brood of which larvæ are found during July, was the one this year which did most harm. This species seemed to take the place in Ontario and resembled very much in its habits and time of appearance, the Variegated Cut-worm, *Peridroma saucia*, of which there has been a disastrous outbreak this summer all through the Province of British Columbia. The larva of *Noctua C-nigrum* is grey or pale brownish of varying shades. When full-grown it is nearly an inch and three-quarters long, rather slender, being less than a quarter of an inch at its widest part. The markings are difficult to describe, and vary very much in intensity. There is always a pinkish sub stigmatal stripe, and the whole of the dorsal area is more or less crossed and darkened by indistinct blackish blotches or mottlings, which on each segment on the dorsum take somewhat the shape of the letter "M" with the top pointing towards the anal end. In some specimens there is a supra-lateral row of spots on each side gradually increasing towards the anal end both in size and intensity of velvety black. On the last segments these are elongated angular blotches with the apex pointing forward. There is also a narrow medio-dorsal pale line and a pale lateral line on each side. However, no two specimens agree exactly in ornamentation, but all have the appearance of being covered with a course network of black more or less obsolete over a pale brown ground colour. The moths appeared in large numbers from July till the end of the season and it is most probable that the eggs are laid in late summer and autumn and that the larvæ hibernate half grown.

Fig. 25.—Moth of Spotted Cutworm.

Fig. 26.–Variegated Cutworm: pupa.

The Variegated Cut-worm (*Peridroma saucia* Hbn.) was also found in considerable numbers, the large caterpillars nearly two inches long by over a quarter of an inch wide, attacking all garden plants and also doing harm in orchards upon apple trees. Some pupæ of this species (Fig. 26) with the moths ready to emerge were found at Ottawa in the beginning of November, but the weather changed immediately afterwards, and it is hardly likely that the whole of this brood produced moths before winter set in. The life history of this species in Canada as to hibernation is not definitely known from actual observation, but from the above incident it would appear as if moths which emerge in July and August, must lay their eggs (Fig. 27) and the larvæ hibernate partially grown. Moths which emerge in October and November probably pass the winter in that condition, and it would also appear as if some must remain in pupa until the following spring.

FIG. 27. — Variegated Cutworm: *a*, single egg, highly magnified; egg cluster on twig.

The remedies for cutworms which have given the best results are the banding of freshly set out annual plants, either with rings of paper or tin, so that this protection extends down about an inch beneath the surface of the soil and an inch and a half or two inches above it. Faded leaves which hang down and touch the ground must be cut off. This protection is particularly applicable for cabbages, tomatoes and tobacco. For clearing infested land either just before planting or when a crop is found to be attacked, the now well known mixture of bran and Paris green gives excellent results. This mixture may be applied either wet or dry. In the latter method the bran should be slightly dampened with water containing 2 or 3 ounces of sugar to the gallon of water. After mixing thoroughly so that the whole mass may be slightly moist, but at the same time feel dry to the touch, dust over it a sufficient quantity of Paris green, green arsenoid, or some other similar poison, to give the mixture a slightly green colour. In the former recommendations it was advised to add the Paris green to the bran in a dry condition; but this is not satisfactory, because on account of the weight of this poison it sinks at once to the bottom when stirred. The bran or meal mixture should be sufficiently dry to run through the fingers easily. It should then be placed in small heaps a few feet apart where the cutworms are thickest and will be greedily eaten by these insects. This is merely a modification of Prof. Riley's trap remedy which has been used successfully for many years. This consists of tying up in small bundles any green succulent vegetation such as any luxurient weed which may be growing by roadsides, and after dipping them in a strong mixture of Paris green and water, distribute them over the land or along the rows of a crop. The greatest drawback to this method of fighting cutworms is the fading of the plant used. This may be prevented to a certain extent by placing a shingle on the top of each, which has the double advantage of attracting the cutworms as a hiding place, and of preventing evaporation from the bundles. It is seldom that plants attacked by cutworms can be treated successfully by spraying, except in the case of climbing cutworms in orchards.

CABBAGE WORMS.—The cabbage crop during the past season has suffered from several enemies. The root maggots caused great havoc in many places among cauliflowers and early cabbages. The Diamond-back Moth (*Plutella cruciferarum*, Zell) was abundant and destructive in dry districts to cabbages, turnips and rape, but the worst enemy of the cabbage crop this year was the White Cabbage Butterfly (*Pieris rapæ*, L.), the green caterpillars of which were so numerous from Peterborough westward almost to Hamilton and also at Ottawa and other places, as to reduce seriously the crop of turnips which, owing to the leaves being destroyed, could not "bulb" Cabbages in fields and gardens were also seriously injured. There are always every year certain insects which are liable to increase and do harm, but the Cabbage Butterfly is one which may be treated with comparative ease. The caterpillars are particularly susceptible to the effects of pyrethrum insect powder, and, if a mixture be made of one pound of this powder with four pounds of cheap flour and the whole be kept for twenty-four hours in a tightly closed jar or canister, and then dusted over the plants, it will kill all of the caterpillars upon which it falls, without injury to the plants and without danger to those who consume them. The proprietary mixture known as Slug Shot has also proved very deadly against "cabbage worms," as these caterpillars are generally called, but this must only be used early in the season while the plants are small, as it contains poison. This insect was probably more abundant during the past season than it has ever been noticed before, but toward the end of the summer it was destroyed in enormous numbers by an epidemic bacterial disease. Caterpillars which were attacked, first assumed a pallid or bluish white appearance and then gradually turned brown in blotches which enlarged until the whole body was a putrid mass. This disease was at its height in the beginning of September and continued to the end of the season. The spread of the White Cabbage Butterfly has been very rapid. It is said to have been imported into America first at Quebec about 1858, from which point it has spread in every direction. Although it had reached the Pacific coast in the United States some years ago, it is only during the past summer that it has appeared as an enemy of the cabbage grower on the coast in British Columbia.

The first record for that province was by Mr. J. W. Cockle who found it at Kaslo in the Kootenay district last year.

The Diamond-back Moth (*Plutella cruciferarum*, Zell.) seldom does very much harm in Ontario but in the West it is terribly destructive to all crops belonging to the Cabbage family, and, owing to the fact that the caterpillars feed almost entirely beneath the leaves, it is extremely difficult to apply an effective remedy. The best results have been obtained with dry powdery mixtures containing poison, blown between the leaves by means of agricultural bellows and insect guns. For this purpose, a strong mixture of one pound of Paris green in 25 pounds of air-slaked lime, or perfectly dry flour, gave good results If liquid applications are used, a sufficient quantity of soap must be added to make them adhere to the foliage of such plants as turnips and cabbages, and a nozzle on an angled support must be used so as to throw the spray well up under the leaves. A knapsack sprayer with a cyclone nozzle answers well for this purpose.

The Root Maggots (*Anthomyidæ*).—These troublesome insects have as usual done a great deal of harm and many experiments have been tried to secure a practical remedy. Unfortunately no very good results have been obtained. Onions, cabbages of all kinds, beans, corn and radishes have suffered. Mixtures containing carbolic acid in some form seem to be the most hopeful. Whale-oil soap gave tolerably good results. The most satisfactory experiments were with early cauliflowers which were protected to a large extent by means of the Gough Tar-paper Discs. These consist of a disk of ordinary tarred building felt with a split from the margin to the centre so as to allow of their being placed around the stems of newly planted cauliflowers. The odour of the tarred paper preventing the flies from laying their eggs, and the tarred paper disc also had the effect of holding moisture around the roots and inducing a copious growth of young rootlets, which were of great service in helping lightly attacked plants to outgrow the injury.

Asparagus Beetles.—The two species of Asparagus Beetles which were mentioned in our last report are still present in the Niagara district and together with the Asparagus Rust have done a certain amount of harm. Fig. 28 represents *Crioceris asparagi*, L, eggs on plant, larva and beetle. They have not,however, spread through the district to the same extent as it was thought they would last season, judging from their sudden appearance in the country in such large numbers. Asparagus growers seem to have grasped the idea of fighting them as larvæ, and a great many beds were dusted regularly with fresh lime when the larvæ were upon them. This seems to have been the remedy which was most used.

Fig 28.

Turnip Aphis (*Aphis brassicæ*, L.).—There has been a decided absence of the Turnip Aphis in most parts of the Province during the season of 1900, except up in the north-western counties. In some places in Huron County the loss has amounted to about half or more of the crop. The eggs for this species are laid in large quantities on the old leaves of the turnips,and where these are cut from the plants and left in the fields it would be well to plough them down deeply, so that the young plant-lice when they hatch in spring would be unable to get out. It would of course be well also to avoid planting a crop of the Cabbage or Turnip family on the same land the following year.

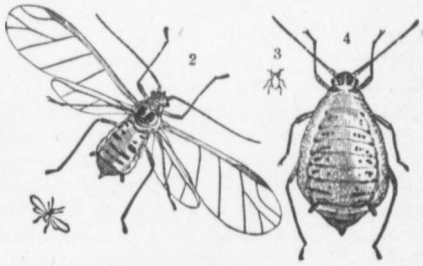


Fig. 29.—Turnip Aphis.

Fruits.

The large amount of attention which has been devoted to fruit trees and orchard pests consequent upon the accidental introduction into Canada of the San José Scale, which is discussed fully in another part of this Report, has had a decidedly good effect in stirring up fruit growers to attend more carefully to their orchards. Spraying has been more regularly and generally done for leaf-eating insects and Codling Moth Late fall

and early spring applications have been made for scale insects and all the operations of the orchard seem to be better attended to than was formerly the case. Fruit growers are learning the habits of many of their regular pests, and there is a much greater demand for information about injurious insects than was the case only a year or two ago.

The CODLING MOTH and PLUM CURCULIO do not seem to have been so destructive, judging from reports received, as usual. The TENT CATERPILLARS which have been so abundant all through the Dominion were decided less destructive last spring. The Eye-

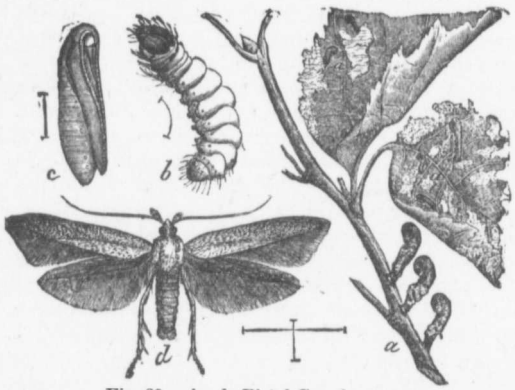


Fig. 30.—Apple Pistol Case-borer.

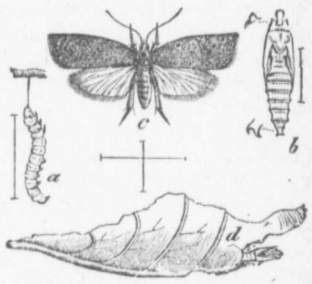


Fig. 31.—Apple Leaf-Roller (*Teras minuta*, var. *cinderella*.

spotted Bud moth and Oblique-banded Leaf-roller did their share of mischief, and early spring insects were rather more than usually troublesome along the shores of Lake Ontario. The Cigar Case-bearer, the Apple Pistol Case-bearer (Fig. 30) and leaf-rollers (Fig. 31) were about equally abundant and where neglected did harm. The species of leaf-roller which seemed to do the most harm was *Lophoderus quadrifasciana*, Fern. From Hamilton larvæ of the PALMER WORM (*Ypsolophus pometellus*, Harr.) were sent at the end of June, and a little later the same thing was sent in from Oakville. This is rather an unusual pest in Canada and had attracted attention from the extreme activity of the caterpillars. The ROSE CHAFER was reported as troublesome on apple trees at Niagara and Grimsby, and the CLOVER MITE did considerable harm to fruit trees all through the western counties where it was generally reported as "Red Spider." CANKERWORMS were destructive in restricted localities during May and early June. The species of which specimens were sent in, proved to be the Fall Cankerworm. The BASSWOOD LOOPER (*Hybernia tiliaria*, Harr.) Fig. 32 was particularly abundant in the Ottawa district, attacking not only apple trees but various forest trees, especially the maple, elm and basswood. In western Ontario, especially in the Niagara district, an interesting little moth, the larva

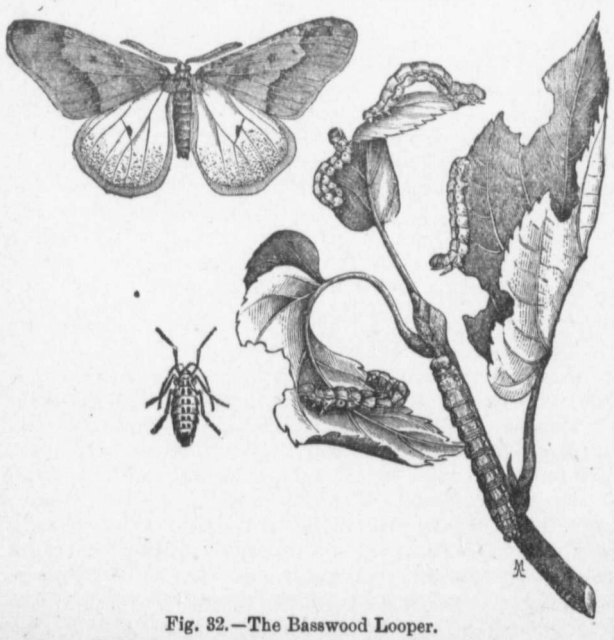


Fig. 32.—The Basswood Looper.

of which mines in apple leaves and sometimes does rather noticeable injury when abundant, is *Nepticula pomivorella*, Pack. The larva when full-grown leaves its mines in the foliage and spins small scale-like brown cocoons on the twigs where it passes the winter. This insect was formerly placed in the genus Micropteryx but it has been discovered by Mr. Busck of Washington that it is a true *Nepticula*.

Pear trees have suffered rather more than usual from three of their enemies. The Cherry Slug in some places has stripped the green cellular parts from the foliage to such an extent as to render the leaves quite useless to the trees, and as a consequence the fruit was ruined. This insect can be very easily kept in check either by spraying with arsenical poisons or by dusting constantly with freshly slaked lime. The Pear Psylla was particularly troublesome at Freeman, near Hamilton, and through the western counties. Mr. Geo. E. Fisher considers this an insect which requires much more attention than up to the present it has received. The mature insect hibernates beneath the flakes of bark on the trunks and larger limbs and can be destroyed during the winter by a 30 per cent. mechanical mixture of crude petroleum and water, or by the ordinary kerosene emulsion. The Pear-leaf Blister-mite is not quite as bad as it was a year or two ago but still is much more abundant than is good for the pear trees or the pocket-book of the fruit grower. On the Pacific Coast this insect is kept well in check with the lime, sulphur and salt mixture. This mixture has not been used very much in Ontario but the well-known kerosene emulsion sprayed over the infested trees just as the buds are bursting has been found very effective. Doubtless the mixtures of crude petroleum and water which are now coming so much into use will be found very effective against the Pear-leaf Blister-mite as soon as the proper portion to use with safety has been discovered.

INSECTS OF THE SEASON OF 1900.

By Prof. W. Lochhead, Ontario Agricultural College, Guelph.

In looking backward over the entire season of 1900 it would appear that insect pests were more numerous and produced greater losses than usual. It is very difficult to determine the exact causes which were operating to produce the results, and valuable indeed would be trustworthy observations along this line. Perhaps the dryness of the season which prevented serious outbreaks of fungous diseases operated on behalf of the insects; perhaps the mildness of last winter enabled many more forms than usual to pass through the dormant season; perhaps parasites were not so numerous as usual; but whether there was one cause or a combination of causes the number of injurious insects was on the increase during the past season. Mention will be made of a few of the most injurious forms brought to the writer's attention chiefly by farmers and others in correspondence with the Biological Department of the Ontario Agricultural College.

Orchard Insects.

The Fruit Bark-Beetle (Scolytus rugulosus). Complaints have reached us from Kingsville regarding the injuries done by this beetle. It attacks especially plum trees, and many of Mr. J. D. Wigle's trees died from the injuries. It is probable that trees in other sections are likewise affected, and watchfulness is required to prevent surrounding trees from becoming infested. From breeding experiments carried on at the College the writer finds that the adults appear about the middle of May. They bore holes through the bark into the wood, and proceed to make burrows in which to deposit eggs. The young grubs also make burrows, and within a month the beetles appear. Several broods may appear in a season so that the trunk soon becomes honey-combed with tunnels and dies. See Fig. 3 (on page 35) which represents the work of an allied species (S. destructor).

Badly infested trees should be cut down and burned, while those but slightly infested should be sprayed with whitewash, or with a mixture of whale-oil soap and carbolic acid.

The San Jose Scale (Aspidiotus perniciosus). This pernicious scale is still with us in abundance, and in spite of the treatment of last spring it is just as numerous as it was last fall. Many new infestations have also been discovered, so that the whole problem of treatment will have to be taken up anew. Mr. Fisher, Chief Inspector, considers crude petroleum more effective than whale-oil soap in killing the scale, but Prof. Webster, of Ohio, maintains that crude petroleum is too dangerous a remedy to put in the hands of the ordinary fruit-grower, and accordingly prefers whale-oil soap. The scale is here to stay and the sooner the orchardist recognizes this fact, and the need of effective treatment to keep it in check the better will it be for the fruit industry of the Province. A great industry is at stake. Can we afford to lose this great industry?

Garden Insects.

The Bean Fly. (Anthomyia radicum)–In June many complaints reached the office regarding the attacks of grubs on beans in Lambton County. One correspondent wrote that hundreds of acres of beans were being destroyed. Many of the beans did not germinate at all, due to the fact that the maggot ate the interior of the seed, and many of the stems never developed leaves through the destruction of the central portion of the stem. Figure 33 shows very well the nature of the work of the maggot both in the seed and the stem. The maggots are about one-fifth inch long and yellowish-white in color. They taper to a point in front and broaden out behind. After feeding for a while the maggots descend into the ground, and change into barrel-shaped pupae. A week or ten days later the flies emerge from the pupa cases and proceed to mate and deposit eggs. After June no further complaint was made, although many growers had replanted their fields. No remedies could be suggested beyond replanting as early as possible, and not as deep as usual. It is just probable that the deep planting of the seed beans was the direct cause of the injury by the maggots, for the usual food of these creatures is decaying matter. The beans began to show signs of decay, and the maggots took kindly to their new food-supply.

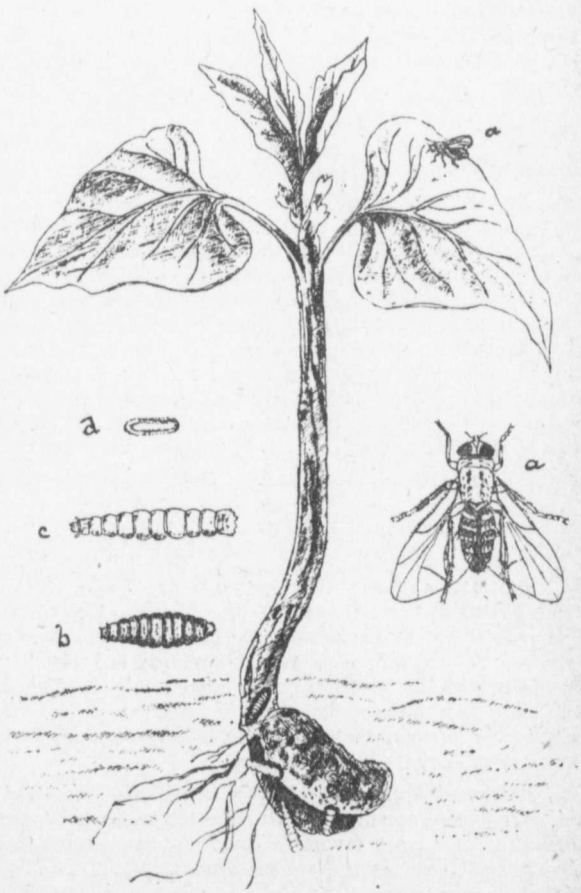


Fig. 33.—The Bean Fly— (a) adult flies; (b) pupa case in ground; (c) maggot; (d) an egg. (After Lugger).

CUTWORMS. (Noctua c-nigrum, Peridroma saucia, and others.) These night-intruders worked considerable damage in gardens and fields during June and July, but the spreading broadcast of handfuls of bran mash, poisoned with Paris green and sweetened with a little sugar, generally put a stop to their depredations in gardens. The most common forms sent in for identification were The Variegated Cutworm (Peridromia saucia), and The Spotted Cutworm, (Noctua c-nigrum).

ASPARAGUS BEETLES. (Crioceris asparagi, Fig. 34, and C. 12-punctatus).—Mr. W. N. Hutt, B. S. A., of Southend, reports to me that C. asparagi appeared very early, just as the first young shoots of asparagus were pushing through, and were three or four times as numerous as last year. The C. 12-punctata appeared two weeks later than the common species, and were even more numerous. The Department sent out a circular in early spring to the newspapers of the Niagara District, which explained clearly the methods to be adopted in combatting the asparagus beetles, but it would seem as if many gardeners failed to pay much heed to the instructions.

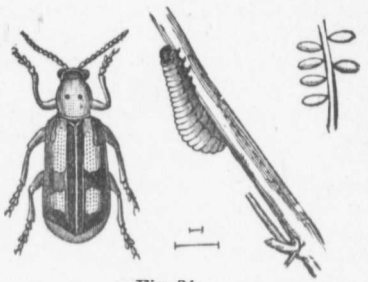


Fig 34.

The westward progress of these beetles has not been very noticeable this year, for although abundant around St. Catharines and Niagara, they have not been observed at Grimsby or Winona. Mr. Johnston reports them, however, from Bartonville, which lies between Winona and Hamilton.

THE BUMBLE FLOWER-BEETLE (Euphoria inda). Fig. 35. This beetle was very common in September and did considerable damage by eating holes in pears and tomatoes. Although the beetles occur in sufficient numbers occasionally to do considerable damage, yet this visitation is but periodical. Recent observations at Washington show that this insect is injurious only in the adult state, and that the grub feeds on manure and humus.

Fig 35.

The beetles hibernate, and eggs are laid in the early part of May, and the grubs mature in about two months. The pupa stage lasts about 16 days. The beetle is readily recognized by its triangular thorax, the yellowish-brown wing-covers mottled with black markings, and the grayish pubescence on the under surface of the body and on the legs and thorax.

The only practicable remedy is to collect these beetles.

FARM INSECTS.

THE HESSIAN FLY (Cecidomyia destructor). The most serious insect pest of farm crops during the past season was the Hessian Fly, which destroyed the wheat crop in many sections. So far as we are acquainted with the conditions surrounding this pest, it is safe to say that the most available remedy is LATE SOWING. Wheat sown as late as the last week in September has been found unaffected, while that sown before was affected. It is evident that farmers as a rule do not make any serious attempt to carry out the recommendations of practical entomologists in the matter of late sowing, trap crops, or uniformity in time of sowing.

The writer urges that this question, a most important one for the Province, be taken up by the Government, and extensive experiments be carried on in various sections to determine the most favorable conditions for sowing to avoid attack. These conditions have not yet been determined for Ontario.

Among the other serious insects infesting farm crops this past season were *Cutworms* which were abundant in root crops, and even in wheat fields (according to some correspondents). The more common species were the *Variegated Cutworm* (Peridroma saucia), the Spotted Cutworm (Noctua c-nigrum), and the Glassy Cutworm (Hadena devastatrix). The use of poisoned bran mashes has been found very beneficial in those cases where the remedy is practicable. A knowledge of the life history is often necessary to know the best time to sow grain to escape the cutworm.

The *Pea-weevil* and the *Pea-aphis* have made the growing of peas an uncertain crop in many localities. There is a practicable remedy for the weevil in the use of carbon bisulphide, or in the holding over of the seed peas for another season, when the weevils will have disappeared and the good seeds can be picked out. With regard to the Pea-aphis, should it become destructive it will be necessary for the pea grower to change his method of cultivation, and adopt drill planting, instead of planting broadcast as is done at the present time.

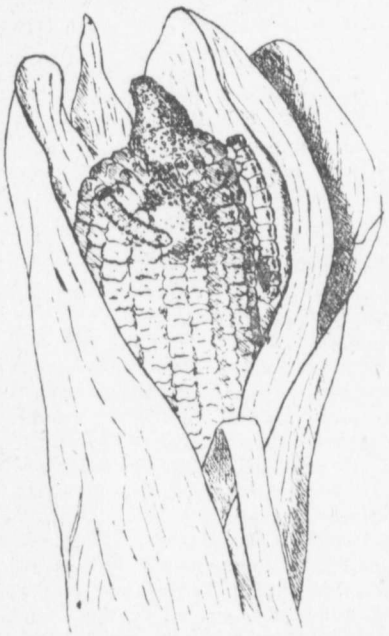


Fig. 36. An Ear of Corn affected by Corn-Worm; Caterpillars are very variable in their markings. (Original).

THE CORN WORM (Heliothis armiger). Fig. 36. This worm has been more numerous this season than usual, and appears to find Ontario conditions quite congenial. The green corn offered for sale in the Guelph market was frequently injured by the worm, and the Experimental Department of the College Farm found many ears badly injured at time of harvesting. The Trent Valley Canning Co. of Trenton reported on October 1st, that they had received a few loads of sweet corn containing many badly injured ears; and that in one locality from which they received corn the worm was very prevalent.

Observations point to the view that the Corn-worm is single brooded with us, but it may be double-brooded in some of the southern localities. Late fall-plowing will do much to break up the cells in which the pupae winter, thus causing the death of the pupae.

GRASSHOPPERS were abundant in late summer, not only in meadows and cultivated fields, but also in gardens where tomatoes, cabbage, celery, and other vegetables were often destroyed. Very likely the dryness of the season and the absence of frost were important factors which contributed to their abundance.

THE CABBAGE BUTTERFLY (Pieris rapae). This insect was more abundant than usual in cabbage and turnip fields, especially in the region lying to the east of Toronto. "Thousands of these winged insects could be seen flying over turnip fields." Although parasites are usually very abundant, it will not do to leave the work of extermination to them alone. A good practicable method of killing the cabbage-worms on small areas especially is to dust a mixture of one pound of insect powder and five pounds of flour through a cheese-cloth bag upon the infested plants.

NATURE STUDY LESSONS ON THE SQUASH BUG (ANASA TRISTIS).

BY PROF. W. LOCHHEAD, ONTARIO AGRICULTURAL COLLEGE, GUELPH.

INTRODUCTION. That a great awakening in the study of nature is in progress must be evident to every person who is watching the signs of the times. Both parents and teachers are demanding the introduction of nature-study into the daily course of the school, and scholars are becoming earnest nature seekers and observers.

The last Annual Report contained Nature-study Lessons on the Cabbage Butterfly, written in response to a desire for information about this common insect by several teachers who had been induced to introduce object lessons of such a nature into their schools. It appears that the lessons were helpful to many teachers, for frequent requests were made for the article during the past year. Believing that an information-article on some other common insect would be acceptable, the writer ventures again to outline a few lessons on the common Squash Bug of our cucumber and melon patches.

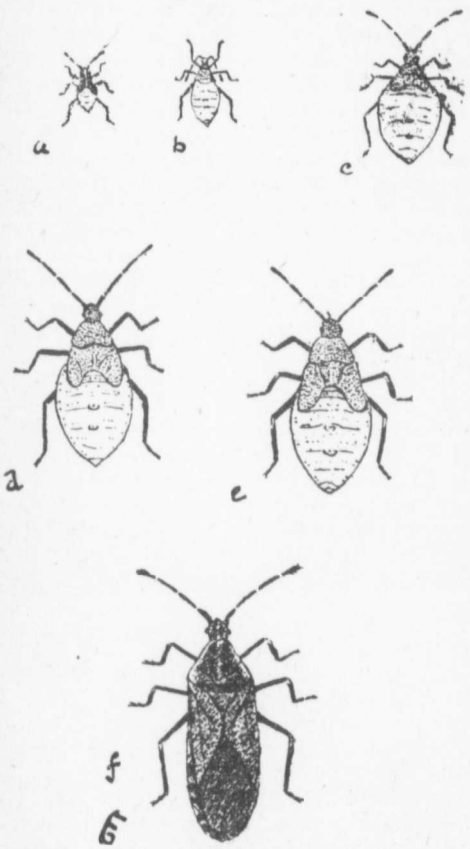


Fig. 37. The development of the Squash Bug. (*a*) The bug soon after it escapes from the egg; (*b*) the bug after the first moult; (*c*) the bug after the second moult; (*d*) the bug after the third moult; (*e*) the bug after the fourth moult; and (*f*) the adult bug after the fifth moult. (Original.)

Occurrence. Who has not seen the dull, smoky-brown insect or bug which hides under the wilted leaves of squash and cucumber in late summer? Or who has not thrown the bug down in disgust when the penetrating foul odour reached his nostrils? In the dead of winter one frequently comes across these bugs in crevices and corners of outbuildings and sheds, where they live in a torpid condition far into the warm weather of the next season. If outbuildings are not to be found the Squash Bugs hide under rubbish, bark and chips, which are usually present in carelessly kept gardens.

General Characters. When one can examine these bugs in spite of the offensiveness of the odour, many characteristic features will be revealed. The three pairs of legs, the two pairs of dark wings, a pair of feelers or antennæ, and the three divisions into head, thorax and abdomen (fig. 37, f) can be readily distinguished, and the thoughtful student will see at once that so far as the major characters are concerned the Squash Bug is similar to the Cabbage Butterfly. It is only when the minor characters, such as the texture of the wings, the shape of the mouth parts, and the size of the feelers and legs are considered that differences sufficient for classification purposes are seen.

Colour.—As to colour the adult winged squash bug is rusty-black, or smoky-brown above, and ochre-yellow below. If a magnifying glass be used it can be readily seen that the ground colour of the whole insect is ochre-yellow, and that the rusty-black colour above is produced by innumerable black dots which cover the legs as well as the wings and upper surface of the body.

It is interesting to notice the change in colour which the young bugs undergo as they pass through successive moults. When the bugs are young the under side of the abdomen is first greenish, then ashy-grey, and finally ochre-yellow. (Are the head and legs always of the same colour as the body?)

Head.—The study of the head of an insect is always instructive. The most prominent part of the head of a squash bug is the feelers or antennae, which are long, and divided into segments, the first and last being the stoutest. (Fig. 38.)

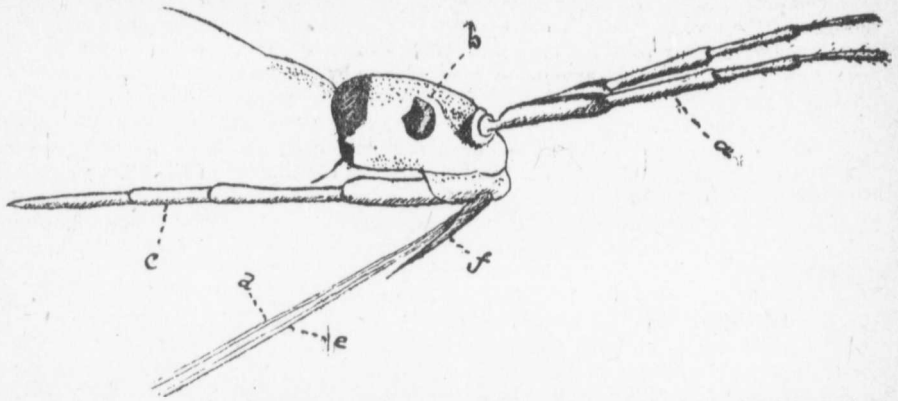


FIG. 38.—The head of the squash bug showing the antennae (a), the eyes (b), the 4-jointed beak (c), the four lances (d) and (e), and the labrum (f), (Original.)

The two large compound eyes situated behind the foot of the antennae are very similar to those of the cabbage butterfly, described and illustrated in last year's Report. In addition to the two compound eyes two simple eyes or ocelli may be seen with the aid of a magnifying glass between the large eyes. They look like minute glass beads.

If the under side of the head be examined a slender beak-like organ can be seen extending from the head backwards beyond the second pair of legs, (Figs 38 and 39), and a magnifying glass will show that this beak-like organ is a 4-jointed sheath, slit along one side. With the aid of a needle further information can be obtained by exposing the contents of the sheath. These are four fine lance-like structures which are apparently attached to a broader appendage near the head. (Fig. 38.)

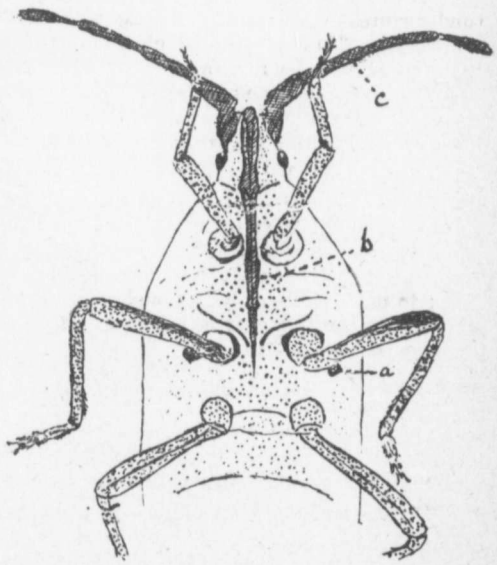


FIG 39.—The under surface of the squash bug showing the position of the two glands, (a) which secrete the foul odour, the beak (b), the antennae (c). (Original.)

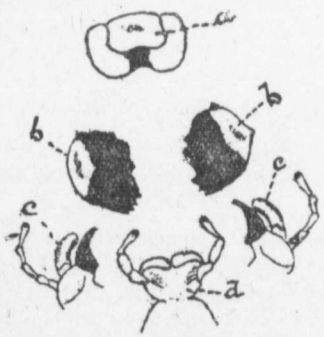


Fig. 40.—The mouth parts of the common locust dissected out, the upper lip or labrum, (a) the mandibles, (b) the maxillæ, (c) and the under lip or labium, (d) (Original.)

The mouth-parts of the common locust are shown in figure 40, and it is evident that the different parts are adapted for biting and holding the object while biting. With the squash bug, however, the parts are not adapted for biting, but for sucking. The lower lip or labium forms the 4-jointed, grooved sheath, and the mandibles and maxillae form the four lance-like piercers, while the labrum is a scale-like flap to which, apparently, the piercers are attached. It will be observed that there are no palpi on either the maxillae or labium, but the parts have been modified for piercing and sucking.

The piercers penetrate the tissues of the leaf or stem, and by means of muscles at the base of the beak the fluids are drawn up. While the insect is puncturing the tissues with the piercers it drops in a little poison which causes the cells close by to wilt and die. Some observers consider the amount of damage done by the poison to be greater than that produced by the loss of sap.

Odour—The cause of the very disagreeable odour of squash bugs is a fluid which is secreted by two glands through two openings on the under surface of the body, situated close to the second pair of legs on the last segment of the thorax. (Fig. 39, a.)

Wings.—The wings of the squash bug are characteristic of the large order of insects to which it belongs,—the Hemiptera, that is, the basal half of each of the outer pair of wings is thickened, while the outer half remains thin, membranous, and veiny. (Fig 41) The under pair of wings are thin and membranous, and are folded under the larger outer pair.

Eggs.—During July and even later the eggs are laid on the under side of the leaves in groups varying from 4 or 5 to 30 or 50. They are dull-red in colour, smooth and shining, about one twenty-fifth of an inch in length, and slightly flattened on two sides.

Nymphs.—The young bugs escape from the eggs in about ten days, and proceed directly to abstract nourishing fluids from the stems. The nymphs may be found in all stages of development under wilted leaves during August and September. (Fig. 37). It will be observed that the nymphs are broader in proportion to their length than the adults are, and their head and first segment of the thorax are small. As the nymphs develop by moulting the wings become longer.

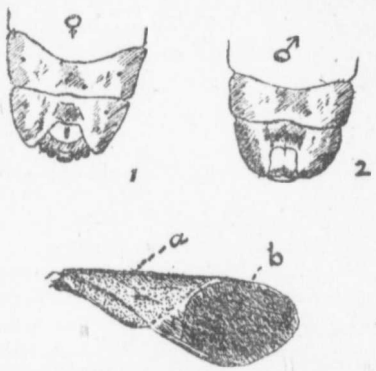


Fig. 41.—The outer wing of the Squash Bug showing the thickened inner half (a) and the membranous outer half (b). (Original)
The last segments of the abdomen showing the differences between the female (1) and male (2).

Remedies.—From the fact that the squash bug does not eat its food, it may be inferred that Paris Green placed on the stems or leaves is of no use in killing the pest. Many substances have been tried, but most have been found unsatisfactory. Kerosene emulsion diluted with 9 parts of water and sprayed upon the vines has given fairly good results, but perhaps the best plan is to clean up the squash patches thoroughly in the fall; to place pieces of boards and chips during the summer among the vines to decoy the bugs, when they may be readily killed; and to pick the old bugs and eggs in early summer and destroy them.

Topics For Observation.

1. The month, and day of the month when the young squash bugs are first observed.
2. The location of the eggs on the leaf,—their number, colour and shape.
3. The hatching of the eggs,—the duration of the egg state, the way the young bugs escape from the eggs.
4. The moulting of the nymphs,—the number of moults, the changes with each successive moult, and the duration of each stage.
5. The offensive odour,—the position of the secreting glands, the use of the fluid to the insect.
6. The best methods of controlling the insect in melon patches.
7. Males and females,—distinction and relative numbers. (Fig. 41, 1, 2).
8. The development of the wing.
9. Parasites.
10. Other insect enemies of the melon patch.
11. Mode of feeding,—the way the fluids are drawn up.

THE BREEDING OF LEPIDOPTERA, WITH NOTES ON THE INFLATION OF LARVÆ.

By Arthur Gibson, Central Experimental Farm, Ottawa.

The value attached to the breeding of insects cannot be over-estimated. The facts concerning the life-histories of species, resulting from careful work in rearing specimens, are of the greatest importance, and any person having a taste for this branch of study has many opportunities of doing excellent work. There is so much yet to be done in studying out the life-histories of insects, and so few people who care to take the time or trouble to do careful work, that those who are disposed have a field in which employment of a useful nature can be found. In the Order Lepidoptera alone there are hundreds of species which have never been properly worked out, and information of an authentic nature in regard to such is much desired. Facts concerning certain stages or habits of even some of our commonest butterflies and moths are badly wanted.

In breeding Lepidoptera from the egg to the imago, there is much of interest to observe. Some of the stages are intensely interesting, as everyone who has attempted breeding with any degree of success knows. The true object of breeding insects is not to get perfect specimens of the imago, but to study their earlier stages, taking careful notes of observations made, and giving the result of information thus obtained to others, through the medium of entomological publications. It cannot be said that such work is hard, but at the same time great care and accuracy are required, without mentioning the need of a good stock of patience.

To meet with the best results, two very important points must be borne in mind, and these are to see that the jars are kept thoroughly cleaned, and that sufficient, but not too much, of fresh food-plant is always present. The larvæ of butterflies, especially, require extra care and attention to see that the breeding jars are always clean, and that the food-plant is kept fresh. Carelessness in this respect oftentimes causes failure. Breeding jars should be washed out at least every day, if the best results are desired, even twice a day is not too often for delicate larvæ. It is also often best to change the food plant twice a day.

In studying the earlier stages in the life-history of a butterfly or moth, as soon as the eggs hatch, it is well to put one of the larvæ in a small jar, keeping it separate from the others, so as to watch it carefully through its different moults. Two could be kept in the same jar, but instead of this it is better to have two small jars, one for each caterpillar. These should be kept beside the remainder of the brood, if any, so that they may also be watched, as many vary in the same stage. It is important that careful descriptions of the egg, the larva (in all its stages), the chrysalis, or pupa, and cocoon, if there is one, should be made, noting in fact everything of importance bearing upon the life-history of the species.

For the most part ordinary jelly jars with tin lids will answer for breeding lepidoptera; those with the rounded bottoms are preferable, as they do away with the chance of moisture gathering in the corners. Two or three different sized jars are more convenient than having them all the same. Of course if a large number of the same larvae are being reared bigger jars or breeding cages, will be found necessary. Some writers recommend tin boxes of various sizes. These also are excellent receptacles, and it is claimed that it is not necessary, when breeding sphingids, to put earth in the tin as the larvæ will readily pupate on the bottom of the box.

Careful watch must be made for the moults of the larvæ. Before moulting the caterpillar, as a rule, stops feeding for a day or so, during which time the front segments become swollen, so much so that they appear larger than the head, which with the cast skin, soon afterwards, usually during the following or the next day, is thrown off. As soon as the larva has moulted, a careful description should be taken, noting its length, shape, colour and arrangement of markings, size and shape of head, etc., etc. The cast skin and head should be preserved in a small bottle, or box, with careful data. The empty cocoon, pupa, or chrysalis, should also be preserved, as well as the egg shells.

A method by which the eggs of many moths may be secured is to capture a female, enclosing her alive in a small box for a day or so, and if she has not already laid eggs, it

is probable that she will do so in confinement. All females, however, will not lay eggs in confinement; from some it is exceedingly difficult to obtain ova. Eggs from butterflies especially are hard to procure, and extra inducements have sometimes to be offered. A good plan is to feed the female with a sweetened fluid, such as honey diluted in water. This can be accomplished by touching the tongue with a fine camel's hair brush which has been dipped in the fluid. Another method to secure eggs is to imprison the female in a bag made of muslin, or some such material, placed over the plant upon which the larvæ feed. In the case of larvæ which feed on low plants such as grasses, etc., if a small plant is transferred to a flower-pot, a covering of muslin, with the aid of two pieces of wire bent into a hoop, can be placed over the plant and the living female enclosed. It is best to have a portion of the plant touching the muslin at the top, as many species will leave the plant and deposit some, if not all, of their eggs on the muslin. If eggs can be secured through a friend living at a distance, they will travel safely through the mail. The present summer several batches of eggs were received at Ottawa from points in the Rocky Mountains, Northwest Territories and other distant localities.

If a number of specimens of the same species are being bred it is nice to have a specimen or two of each larval stage inflated, as it is important that as much of the life history as possible be preserved for the cabinet. If the first stages are too small to inflate, they can of course be preserved in alcohol, or some other fluid, or they may be dried on hot sand with some success. There are various methods of inflating larvæ, and some experience is needed before satisfactory results will be attained. Hairy caterpillars especially are difficult to inflate, but experience will teach the beginner that great care and much patience are required in order to do good work.

For inflating larvæ very few appliances are necessary, and these are not at all expensive. They can easily be had from most of the dealers in entomological supplies.

When the larva has reached the stage at which it is to be preserved the first thing to do, of course, is to kill it, and this can be done by dropping it for a minute or two into a receptacle containing methylated spirits. When the caterpillar is dead it can be taken out of the liquid with a small pair of forceps, and placed on its side on a piece of blotting paper. When this is done take a small piece of the same paper in the left hand placing it over the larva, gently pressing the front segments, with exception of head. A small sharp pointed instrument should then be inserted into the anal orifice, so as to admit of some of the liquid contents coming out. For all except minute larvae a large needle, or a pair of small forceps with curved points, may be used for this purpose. Further pressure will now be necessary in order that the remaining contents may be squeezed out. Just sufficient pressure should be applied to remove the contents; if too much is given the skin will be bruised.

When the viscera have all been removed, insert the necessary-sized glass inflating-tube into the anal orifice. The larger of these tubes have clips or spring attachments to hold the larval skin. If the caterpillar be small it can be fastened to a smaller tube by means of a thread of fine silk wound around the posterior segment. The inflating-tube can now be inserted into the rubber tube of the double bulb inflator and the empty skin gently inflated. If everything is all right it can then be placed in the oven and slowly dried. A suitable oven can be made by any tinsmith, and is simply a tin box about 6 inches long by 4 inches wide and 2½ inches deep, supported on legs to allow of the lamp being placed beneath it, and having an opening in one end to insert the larva, with another at the bottom for the circulation of air or to allow the escape of some of the heat. A sheet of glass let into the top enables the operator to see what he is doing. The drying process should be carried on over the hottest place, commencing with the front segments and working backwards. Care must be taken not to hold the same portion of the larval skin too long over the heat, but the segments that are being dried should be kept turned, so that all sides may be dried about the same time. While this is going on too much air must not be pumped into the skin; if this is done it will stretch the larva and give it an unnatural appearance.

Any small spirit lamp will do to supply the heat, which must be regulated according to the nature of the species being inflated. Too great a heat will destroy the colors of many larvæ, and this is especially so in the case of delicate green caterpillars. Hairy larvæ, as already mentioned, are rather difficult to blow, as the hairs are very easily rubbed off, and unless care is taken in the inflating the segments will be sure to expand

too much and thus be puffed out unnaturally. When the skin is ready for the oven a pair of forceps will be found a means of help in inserting the inflating-tube into the vent.

After the larval skin is thoroughly dried care should be taken in removing it from the inflating-tube. This can easily be done in most cases by simply forcing the skin off the tube by means of the thumb-nail of the right hand. The caterpillars may then be mounted on a piece of fine wire wound tightly around the pin five or six times, the lower end of the wire being neatly cut off. The portion on which the larva is to be mounted may be cut according to the size of the caterpillar. Any good cement, such as that used for repairing insects, may be employed to fasten the blown skin to the wire.

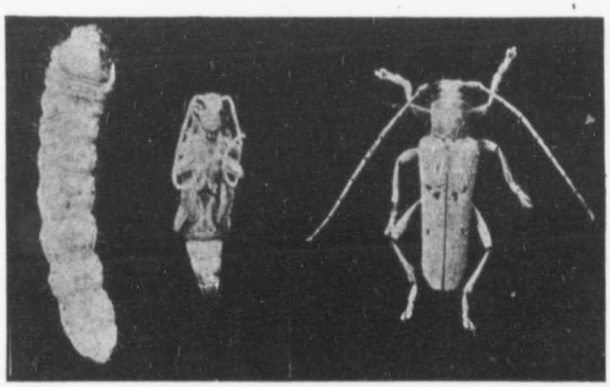
NOTES ON TWO LONGICORN BEETLES AFFECTING GROWING NURSERY STOCK.

By F. M. Webster, Wooster, O.

With the rapid changes in the flora of the country, brought about by advance in our civilization, there must of necessity come changes in the habits of such of the animal life as is dependent upon this flora for their food supply. Nor do the influences stop here, for it is frequently not difficult to observe the effects of such changes even in the parasitic enemies of these animals.

Hardly a season passes but that some old and well known insect exhibits some characteristic not before observed. Sometimes this, to us, new phase of its sociology may not again be noticed for years, or it may continue and indeed increase to such an extent as to become a normal characteristic of the species. As instances of this change of habit, the adult of the Western Corn Root Worm, *Diabrotica longicornis*, was formerly known only as a green beetle found on the blossoms of thistle and golden-rod; whereas, now, it swarms over the corn fields of the middle West in myriads, and the larvæ are one of the worst pests of the corn field. It is only within the last three years that the two ground beetles, *Harpalus caliginosus*, and *H. pennsylvanicus*, have come into prominence as strawberry insects.

The first species here considered is the coated Saperda, or the Linden borer, *Saperda vestita*, Say (Fig. 42) described in 1824, from specimens taken near the southern extremity of Lake Michigan, but was also known at that time to occur in Pennsylvania. Though common, the insect does not appear to have anywhere become seriously destructive though it was well known to Harris as early as 1832 and said by him to have been destructive to the European Linden in Cambridge, Massachusetts, in 1843 and 1844.



1 2 3

Fig. 42.—*Saperda vestita* Say; 1, larva; 2, pupa; 3, adult; all slightly enlarged.

Dr. Paul Smith, in a letter written May, 1844, quoted by Dr. Harris in his "Insects Injurious to Vegetation" gave an account of an attack upon European Linden trees in Washington and Independence Squares, Philadelphia. The trees were attacked about seven years before but within two years it had been found necessary to cut down forty-seven of these European Lindens in Washington Square alone. The American Lindens were also injured but apparently to a less degree. One of the Lindens mentioned by Dr. Harris was very large, the trunk measuring 8 feet, 5 inches in circumference 5 feet from the ground. A strip of bark two feet wide at the bottom, and extending to the top of

the trunk, was destroyed, and the exposed surface of the wood was pierced and grooved with countless numbers of holes where the borers had been bred, and whence swarms of these beetles were supposed to have issued in past times. Some of the larger limbs and a portion of the top of the tree fell down, apparently in consequence of the ravages of these insects.

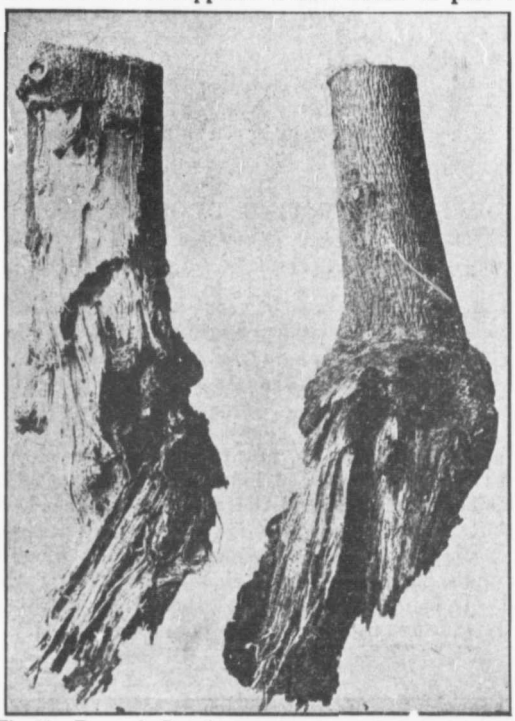


Fig. 43.—Bases of affected trees, about natural size. Original, after photographs by P. A. Hinman.

In the American Entomologist, New Series, Volume I, page 271, Dr. C. V. Riley cites the species as very injurious to the European Linden in Cambridge, Massachusetts, and Philadelphia, Pennsylvania, quoting Harris as authority, and also adds "boring at the base of young European Lindens and gouging two parallel rings around the trunk which form annular swellings." Thus it will be seen that the insect exhibits a partiality for the European Linden, but its injuries during later years do not appear to have attracted the attention of entomologists to any large degree. Last year, my former assistant, Mr. Mally, while inspecting nurseries, found a number of small Linden trees in the nursery row that had been very seriously injured by larvæ burrowing in the trunks below ground. Mr. Mally, from the appearance of these larvæ, thought they might be those of the Round-headed Apple Tree borer, *Saperda candida*, the adult of which is shown in Figure 44. These young trees growing in the nursery row were cut and transplanted to the insectary on the 28th of August. On the 15th of January, 1900, examination of these trees (Fig 43) revealed one larva still active in the rotten wood, and about four inches below the surface of the ground. On April 4th one adult *Saperda vestita* emerged. It must be remembered that this was under insectary conditions. The next day the entire lot of material was examined. One additional larva (No. 1.) and a pupa (No. 2.) were found. These larvæ had worked in the wood at the root, entirely below the surface of the ground, and, in fact, the upper limit of their burrowing was from two to four inches below the ground. When ready to pupate the larvæ evidently burrow their way upward in the wood to the level of the ground surface, or within an inch or two of it. They pupated in cells cut

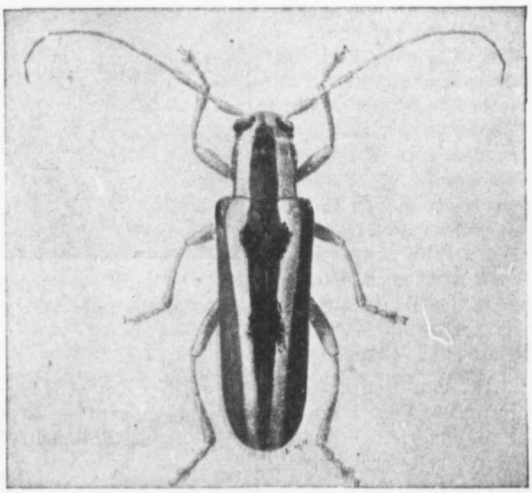


Fig. 44.—*Saperda candida* Say.

diagonally across the grain of the wood at an angle of about 45 degrees to the upward channel.

So far as known to me this is the first instance of this insect having been observed attacking nursery trees, and also the first record of their working below the ground. All previous records represent them as working above the surface, their attacks being confined to the trunk and larger branches.

Dr. Harris states that the adult *Saperda vestita*, after having emerged from the trunk and larger branches of the trees, will fly into the top and there feed upon the epidermis of the tender twigs and the petioles of the leaves, often wholly denuding the latter and causing the leaves to fall. It may not be out of place to state that a few years ago a specimen of *Saperda candida* (Fig. 44) was sent me, accused of gnawing into the young growing apples, and specimens of these that accompanied the insect gave abundant evidence of the truth of the statement.

The species under consideration is said to deposit their eggs, two or three in a place, upon the trunk and branches, especially about the forks, making slight incisions and punctures for their reception, with their strong jaws. As many as 90 eggs have been taken from a single beetle. The larvæ, hatching from these eggs, undermine the bark to the extent of six or eight inches, often penetrating the wood an equal distance.

This appears to be an instance of an old and well known species taking on a new habit, as I can find nothing on record of their having ever been before observed depredating in the nursery row, and there is certainly nothing on record relative to the larvæ working below the surface of the ground.

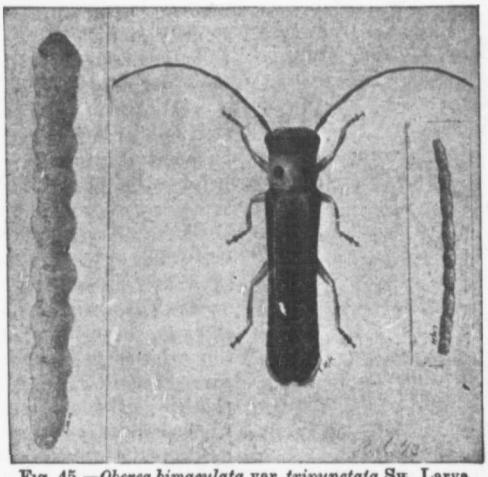


Fig. 45.—*Oberea bimaculata* var. *tripunctata* Sw. Larva enlarged at left; Section of excreta at right, all enlarged.

The second species, with which this paper has to deal is *Oberea bimaculata*. While this is, perhaps, more of a small fruit than a nursery pest, nevertheless, we have come in contact with it in our nursery inspection, although not especially as affecting nursery stock. In Bulletin 96 of the Ohio Agricultural Experiment Station, pages 20-22, I gave an account of this insect and stated that we had reared it from witch hazel *Hamamelis virginiana*, also from apple twigs. The specimen is shown in Figure 40. A further study of this insect has shown that it is *Oberea tripunctata*. Specialists make this a variety of *bimaculata*. Since this work was done, I have twice reared the true *Oberea bimaculata* from raspberry, which it is known to infest. There seems now to be a dividing line between these two forms, *tripunctata* having a variety of food plants, while *bimaculata* appears to confine itself to canes of *Rubus*. The object in presenting this matter is to correct a possible error in Bulletin 96, in terming the species there reared from witch hazel and apple twigs, *Oberea bimaculata*, without further qualifications. Although as stated, the two are considered to be the same species by systematists the rearings at the Station imply that there is a sharp distinction between the two in the matter of food habits, and it seems to me that this would be very strong evidence at any rate, that may, some day, be used in separating the two insects. Any one wishing to follow up our studies of these species will find them recorded in Bulletin 96, of the Ohio Agricultural Experiment Station, pages 20-22, and the Journal of the New York Entomological Society, Volume V, pages 203-204, with illustrations, and Volume XI, pages 437-438 of Entomological News. It will be a very interesting study, and one fraught with some economic importance, to carry on a large number of rearings, both from *Rubus* and other plants. If this food distinction between the two forms holds good throughout, *Oberea tripunctata*, Swederus will be entitled to rank as a species.

A very valuable contribution to our literature upon these insects will be found in Bulletin 23, Agricultural Experiment Station, Cornell University, pages 120-24, by Professor Slingerland. The two forms are so exceedingly alike in appearance that none but expert entomologists have been able to separate them. As relating to this matter Mr. F. H. Chittenden, Assistant Entomologist in the Department of Agriculture, wrote me Feb. 8th, 1899, also stating that he had been unable to avoid the impression that the two insects were distinct, notwithstanding the opinion of specialists to the contrary. I speak of this more in the way of a suggestion, as it seemed to me a problem which a careful entomological student may well take up and solve.

HABITS OF THE LARVÆ OF DERMESTES TALPINUS (MANN.)

By Percy B. Gregson, Waghorn, Alberta.

To fur trappers in the far North West the larva of this beetle, which Dr. Fletcher has kindly identified for me, is but too well known. (Fig. 46.) It seems to be ubiquitous and almost omnivorous. Hitherto, however, it has been understood to feed only on dead things, such as fur hide, skin, bacon, wool, dead insects, etc., but in rearing it, as I have in considerable numbers, I have noticed features which show the larva in its very early infancy to be endowed with a very extraordinary activity, or to be a parasite of living insects. These features I should like now to record.

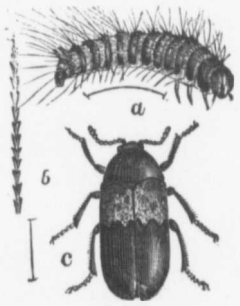


Fig. 46 represents the beetle and larva (magnified) of *Dermestes lardarius* — a most familiar species.

My practice when spreading lepidoptera is to place the setting-boards within a box with closely-fitting door, but the frequent destruction of the insect by the Talpinus larva, before the insect itself had become sufficiently set for removing, determined me to investigate the early existence of the larva. I noticed that the butterflies I caught in May and early June (*Colias occidentalis, E. discoidalis*, etc.) were peculiarly liable to attacks by this pest. Others caught later in the year were free from them. When I discovered the larva on the setting-boards (generally on the second or third day after setting the insect) the largest of the larvæ did not exceed one line in length, and from the dust-like frass under the body of the butterfly and the excavation made in the body, the larva had evidently been at work for some time. It being easily possible for such minute creatures to have crept through some small crack into the interior of the box, I decided this year (1900) to rear a few, as soon as I could get any, in a tightly closed tin tobacco box three inches deep, for I found they could not crawl up the tin sides of such a box. They cannot crawl up tin at any slope greater than 30 degrees. Placed on the higher part of such a slope, they slide down to the bottom.

On the 12th of May, 1900, I found a *D. talpinus* larva on a hybernated specimen of *Vanessa cardui* which I had captured and spread on the 10th. This little larva (not a line in length) I at once placed in the empty tin tobacco box, with the carcase of the *V. cardui*, and closed the lid and saw that there was no space for ingress of even the minutest insect, assuming that it first could scale the tin sides of the box. Being much occupied for the next few days, I simply added a Colias or two (caught in the manner I shall presently describe) without disturbing the little grub which was within the carcase of the *V. cardui*. On the 25th May I introduced to him a *Colias occidentalis* caught that morning. I always carry with me when hunting near home for lepidoptera, a shallow ($\frac{1}{2}$ inch deep) tin cigarette box whose lid fits very tightly, requiring an effort in fact to open, and into this box I at once place, direct from the net, my captured specimens, folding them in papers on the spot (first, however, killing the Colias, Erebias and such sized insects by pressure on the thorax in the net) and it is therefore impossible for

any foreign insect to gain access to the interior. I followed this course on the 25th May, and the *C. occidentalis* I introduced to the Talpinus larva I took direct from its paper in the shallow box, as I did all the insects with which I fed my Talpinus, and dropped it into the larger tin box. On exploring the interior of this box in the evening of the 25th I found a second Marmoratus larva (very minute) feeding on the body of the newly introduced Colias.

On 28th May I introduced another *C. occidentalis*, caught under and treated in precisely similar fashion to the others above mentioned, and soon afterwards observed a third little Talpinus larva on the bottom of the tin box. There were now three of these larvæ, and for the first time I introduced to them a small piece of coyoté fur. This, however, was not touched until the carcases still remaining had been devoured, and there was no further increase in the family. On the 4th June, however, I placed two more fresh *C. occidentalis* in the box (both caught as before) and as I had now become accustomed to mysterious additions to the family I presently observed without surprise a minute Talpinus crawling from just under the right wing of the last introduced butterfly. Here then were four larvæ, all of which had been obtained through freshly captured butterflies, and none of which could have possibly crawled into the deep, close-lidded tin box, nor can I imagine that they could by any possibility have gained admission to the shallow tin collecting box and to the folded papers within, unless they were already on the bodies of the butterflies when captured. In which case their activity seems little short of marvellous.

Although on subsequently ceasing to feed the larvæ with butterflies they ate the fur hide, they nevertheless deserted it again for bodies of insects when I once more introduced that kind of food. I have even found one in the dead body of a common house fly.

In closing these few remarks I may add that I procured a dozen of these larvæ from butterflies in the above described fashion this year. The first to pupate did so on 7th July and hatched on 9th August.

OBSERVATIONS ON SEVERAL SPECIES OF DERMESTIDÆ.

By F. M. Webster, Wooster, O.

The necrophagous habits of many of the species of this family of insects are well known, but it is doubtful if the phytophagous habits are very much less emphasized in other species.

Byturus unicolor Say, is, perhaps, best known as the Raspberry Fruit beetle, and I have observed it feeding, usually in pairs, on the blossoms of *Geum*, either *rivale* L, or *album* Gmel. *Byturus tomentosus* Fab., is destructive to the Raspberry in England.

The common introduced species, *Dermestes lardarius* Linn., while affecting dried skins, meats, etc., is also fond of bread and other grain products, and has twice been reported as destroying honey comb. *D. vulpinus* Fab., has been reported as damaging tobacco.

Perimegatoma cylindricum Kirby, var. *angulare*, has been reported as a possible enemy of the Fluted scale, *Icerya purchasi* Maskell.

Attagenus piceus Oliv., has become so destructive to woolen fabrics and carpets as to receive the name of Pitchy or Black Carpet-beetle. It has been sent to me from Indiana breeding in beet seeds, larvæ, pupæ, and adults all being present in the seeds when received.

Trogoderma ornatum Say, though beyond a doubt a museum pest, is a vegetable feeder as well. From the seed of the garden sunflower, collected May 28, 1899, this beetle emerged, in the insectary, June 17, 1900. From seeds of *Ambrosia trifida*, collected October 10, 1899, a specimen emerged in the insectary, May 19, 1900. From seed cluster of *Euthemia graminifolia*, collected October 12, 1899, beetles emerged in the insectary, March 31, 1900. These seeds were infested by unknown larvæ when collected.

Anthrenus scrophulariæ Linn, so well known as a carpet beetle, I have, for years, found in abundance during early spring, in the blossoms of the Tulip, and almost invariably in those of a pure white color, or nearly so. I fully believe that this is more

of an out of door insect in this country than we at present suppose, though we know that, at home in Europe from whence we received it, the insect is unknown as a household pest.

Anthrenus varius Fab., I have taken in the blossoms of Tulip, in connection with the preceding, and also by itself in the Peony blossoms in June. A single individual was found in a breeding cage, supposed to be secure against the ingress as well as the egress of the smallest insects, in which were thorns of the Honey Locust, infested with lepidopterous larvæ. Of course, in this case, the beetle might have made its way into the cage, though the probabilities are that it did not. I have reared either this species or *A. musæorum* Linn., from masses of spiders' nests mingled with the bodies of dead insects, as well as the living, in hibernation, under the loose bark of a hickory tree.

NOTES ON DANAIS ARCHIPPUS.

By C. W. Nash, Toronto.

During the past season (1900) I have made the following notes of the movements of this butterfly in the neighbourhood of Toronto :

June 14th.—Saw first Archippus butterflies. There were three of them loitering over the willow bushes near the shore of Lake Ontario. They were much faded and ragged ; all of them were flying eastward.

June 20th.—Archippus butterflies are now common. All are very dull coloured ; their scales being worn off and wings ragged, they look old.

July 21st.—I examined a large number of Asclepias for Archippus larvæ, but found only one, about half-grown. The butterflies are common, but all seen are dull and worn.

July 22nd.—On a small patch of Asclepias, near my house, I found a number of Archippus larvæ of various sizes, some very small and ranging up to full-grown ones ; also found several chrysalids.

I watched several of these chrysalids for some time, but not one of those I kept under observation produced a living butterfly. In each case the insect reached the perfect stage, or nearly so, and then died in the shell. None of these appeared to be parasitized ; they simply dried up.

August 5th.—Archippus butterflies are now congregating about the trees near my house, where they roost ; some of the flocks contain over one hundred. These are all large, bright coloured specimens, evidently produced this season.

September 4th.—Archippus butterflies were streaming along the lake shore in myriads all this afternoon. I travelled through the flock for about five miles, and in that distance there was no break in the flight ; all of them were flying westward. At times individuals would alight on the ground, always with their heads pointing westward. They seemed generally to select a shady spot to alight on, and in some places the ground was covered with them. After resting a few minutes they would get up again and go on with the flying crowds. The wind was from the north-west, very light, in fact scarcely perceptible.

Just at sunset I visited the trees they frequent near my house and found a great many roosting there.

September 6th.—Very few Archippus butterflies about to-day.

September 7th.—Only saw a few individuals.

September 28th.—Saw a few Archippus butterflies to-day, perhaps half a dozen.

October 6th.—A few Archippus still about.

Prof. Comstock and some other entomologists say that no birds will eat the D. Archippus. This is a mistake, so far as the butterfly is concerned, for I have myself taken them from the stomach of cuckoos. So far I have not identified the larvæ in the stomach of any bird, and it may be that they are never eaten by them.

[At London, Ontario, this year the Archippus butterfly was seen as late as November 2nd. A specimen captured on the 27th of October lived for over a fortnight in the Society's room and died apparently from a chill, as it had been left on the windowsill one cold night.]

THE PRESENT STATUS OF THE SAN JOSÉ SCALE IN ONTARIO.

By Prof. Wm. Lochhead, Guelph.

It will be remembered that the Government relaxed its strong policy of extermination in May of 1899, owing to the great opposition which was encountered. Nothing was done by the owners of the infested orchards to prevent the spread of the scale until the spring of the present year, 1900, when the Government came to their help and offered to provide whale-oil soap and crude petroleum at half price. While many orchard men took advantage of the liberal offer, it is yet a regrettable fact that many failed to buy soap or crude petroleum, or to use any other remedy. Inspection of the treated orchards, moreover, reveals the fact that the spraying was often done carelessly, or too little of the soap was used per tree. As a result of such careless treatment the scale is even more abundant at the close of this season than it was at the close of last season and the infested trees are more plainly detected. It may be said with a great deal of truth that in the infested areas of Guilds and Niagara no orchard is free from scale, and orchards which had not more than ten per cent. of the trees marked for scale last year have now scale on nearly every tree. While careless treatment has done so little to check the spread of the scale, yet some good results have been secured by careful spraying with good whale-oil soap and crude petroleum. Where whole blocks were treated carefully the intensity as well as the spread has been checked appreciably, and some of the best fruit was picked from trees which had been marked for one or two years.

In the Niagara and St. Catharines districts the owners are, as a rule, indifferent, and the impression seems to have spread that the scale is not any worse, if as bad, than some other evils against which the fruit-grower has to contend, and which are infesting orchards, such as *Yellows*, *Rose-Leaf*, small peaches, *Blight*, etc. A cursory inspection fails to show many apple trees which have given way, but many dead limbs can be found, as well as many dead peach trees.

In the Guilds district, Kent county, the scale has gained great headway and moderately infested orchards of last spring are now badly infested, for no spraying was done to check the progress of the pest. There, however, the owners are beginning to realize the necessity for action, and several have already purchased spray pumps and are preparing to combat the scale with vigor this coming winter and early spring. Time is evidently required to educate the fruit growers to give their orchards proper care.

It is difficult to state with any degree of certainty the extent of spread of the scale to new districts since the work of inspection of orchards was discontinued. Two new locations, however, have been discovered accidentally—one noted in London East by Mr. J. Dearness, and another at Essex Centre by the writer. The latter case was a very severe one, and it is probable that the scale has spread a considerable distance from this new centre.

Opinions differ as to the relative merits of good whale-oil soap, and crude petroleum. Some consider the latter a too dangerous remedy to be applied by careless sprayers, and prefer to continue the whale-oil soap treatment. Others, again, maintain that crude petroleum has given better results, both in controlling the scale, and in invigorating the trees. As a result of the experiments this year some valuable points have been gained. The whale-oil soap must be of a certain standard of quality to give results at all effective, and in the application of the crude petroleum good results depend on the method of spraying—i.e, in the handling of the nozzle, rather than on the percentage of oil, as Mr. G. E. Fisher has already explained to this meeting.

A PARASITE OF THE SAN JOSÉ SCALE.

By John Dearness, London.

Last year I received a packet of twigs bearing scale insects, mostly San José, from Mr. John Gordon, Guilds P.O., Kent Co., on some of which there were parasitic mites preying at least on the well-grown females of the species of scale insect named. On some

specimens received this year from the same neighborhood these mites were very numerous. I mounted some specimens and with a female S. J. put them in the Society's collection of microscopic slides. As many as eighteen larval mites were observed under one large scale.

Mr. N. Banks, Washington, a well-know expert on mites, reports it *Tyroglyphus malus*, Skinner, which is known to prey on the larvæ of the oyster-shell bark louse. Dr. Howard writes that J. Lignières published a valuable article on this mite in the proceedings of the Societé Zoologique de France in 1893. The habits of the mite are given accompanied by excellent anatomical figures.

"The San José scale is spreading very fast this year" in Ontario. This statement was made again and again last season, and it is repeated this year. Some people who have heard it, have inferred that since the suspension of the cutting and burning of affected trees the insect has multiplied at a more rapid rate than formerly. The discovery of new areas and new locations of infestation does not prove that the scale has increased abnormally last year and this one. That the pest was not in these newly discovered infestations in 1898 or in previous years is only an assumption ; to say that the township or even the orchard was inspected in that year does not by any means prove that the scale was not there.

The officers' assurance in 1899 that the scale was well-nigh "surrounded" was based on the belief that by tracing the deliveries of stock from the few infested nurseries all initial points of its distribution could be located. The possibility, nay the probability, of a more general introduction may be reasonably suspected from a consideration of the methods adopted by some nursery agencies. For several years past, as a county school inspector, I have received one or more circular letters asking for a list of the addresses of the teachers in the county, the reward usually offered for the trouble was one or more young trees or flowering shrubs. The teachers whose addresses were thus obtained were urged to do some canvassing in their respective neighborhoods, or, in some cases, to send a list of orchard owners or probable purchasers in consideration of a like reward to that just mentioned. The badly infested New Jersey nurseries were as likely as any others to supply stock to the jobbers who sought to use the teachers as distributers of it.

In addition to the stock imported and scattered all over the country by jobbers there is no doubt that individual farmers here and there imported young trees direct from the nurseries. Dealers would not put and keep their advertisements in the papers without seeing some benefit from them. These are some of the facts to be considered before accepting the conclusion that all or nearly all the centres of infestation in Ontario were known in 1899 and that new ones are due to the interruption of the methods in operation in the spring of that year. Incalculable good came from the tracing and destroying of affected nursery stock. Upwards of a hundred centres of evil were thus probably rendered harmless. All that the San José scale has cost Ontario has been doubly and trebly repaid by this action alone. On the other hand harm came from the sense of false security begotten of reliance on the reports of immunity based on a superficial examination of the orchards in the fruit growing townships.

The hope for the future successful disposal of the scale-insect difficulty lies not in legislative intervention but in education. Every farmers' institute and every schoolhouse should be a point from which light should be thrown on the nature, life-history and method of treatment of our insect and fungal pests. Lessons on the scale insects could be made as useful and made to yield as good training for the observing and reasoning powers as an equal number of lessons in spelling, algebra, arithmetic, etc.

In August Rev. Mr. Seaborne discovered an infestation of San José scale in London East. In September Mr. Ellwood of St. Thomas sprayed the trees with a very dilute solution of coal-oil to which some common salt was added. He claims that the salt makes the solution more effective against the insect without correspondingly endangering the vitality of the tree. I visited the place twice since Mr. Ellwood's treatment. The leaves of the sprayed trees were injured more or less, but I found no living scale. On one branch I took away there were two females found which did not appear to be dead. On a branch taken subsequently no living scale insects were found. The developments of next spring will tell whether the treatment is effective.

THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.*

The twelfth annual meeting of this society, which was founded in Toronto in 1889, was held at Columbia College, New York, on the 22nd and 23rd of June, 1900. In the absence of the President, Prof. Bruner, the chair was taken by the Vice-President, Prof. C. P. Gillette, who read an address on "the objects of the Association of Economic Entomologists." The first of these is "to discuss new discoveries." This implies, the speaker said, that new discoveries are to be made. It takes for granted that the members are to be scientific workers and not mere book students, content to thrash over old straw or to step exactly in the footprints of another. After referring briefly to Dr. Riley's "introduction of the Vedalia to the relief of disheartened fruit growers" in California, and to Dr. Howard's having made possible the successful culture of the fig through the establishment of *Blastophaga grossorum*, he stated that it would be difficult to find so small a body of workers, with so meagre an amount of time to be devoted to original research, in any other science who can show larger results in the way of new discoveries in so short a time.

A further object is "to exchange experiences and to carefully consider best methods of work. No one can be a toiler in any special line for a year without encountering experiences that might be related to a fellow-laborer to his profit. We are scattered over a large territory, having widely varying conditions of climate, altitude, and plant and insect life. Each can bring from his particular field some points of peculiar interest to all the others. While we may read one another's publications and perhaps exchange frequent letters until we almost feel acquainted, it is only occasionally that we can enjoy these meetings together, and it is a great inspiration to talk freely over one's experiences and plans of work face to face with those who are interested with him in similar lines of labor."

"The student of applied entomology is supposed to have a good general knowledge of agricultural affairs, particularly in regard to plant growth. He must be informed upon all the insecticide materials and be able to tell what insects they are suited to kill, in what strength they may be applied to different plants, what their physiological effects will be on both plant and insect life, and when they can best be applied. He is supposed to be able to tell at a glance what any insect is that may be handed him, and whether or not it is injurious or beneficial. He is expected to be able to recommend the cheapest and best pumps or other machinery for the application of insecticides. Is it any wonder that we need to get together and exchange experiences and discuss methods of work, particularly when we remember that different results are obtained in different localities? Lime, salt and sulphur, so valuable for the destruction of San Jose scale on the Pacific coast, were found to be of very little value in the moist atmosphere of the eastern portion of the country; the codling moth, said to have one brood in Maine, is reported to have two in Colorado, and three or four in other places; insects fairly common but never seriously abundant in one portion of the country are often found to be great pests in others. In view of these conditions it is important that we obtain all the ideas possible from fellow-laborers in different localities, that we may make as few mistakes as possible, and that we may not bring down upon ourselves the distrust of those whom we labor to benefit."

"We are also 'to consider best methods of work.' Method is always important, and particularly is it to be sought for in a young science or industry where long experience has not yet determined the best plans of procedure. It was well at first that a large amount of individuality should enter into the work and a variety of methods be employed. Then, by a process of natural selection, the poorer methods would gradually drop out and the better ones be retained. It is time for this Association to lay aside its swaddling clothes and assume the garb of maturer years. It should be one of its objects to determine upon best methods as soon as expedient to do so. One recommends Paris green or London purple in the proportion of 1 pound to 200 gallons of water, while another will make it one pound to 160 or even 100 gallons for the destruction of the same insect. One recommends two sprayings for the codling moth, another three,

* The Editor desires to acknowledge his indebtedness to the official report of the proceedings of this meeting published by the U. S. Department of Agriculture.

and another says spray often enough to keep the fruit covered with a layer of the poison, so as to be sure of killing the second brood. Some advise hellebore for the pear slug, while others prefer one of the arsenites, and still another would use quicklime or simply road dust. Surely there is need for more method and uniformity in our work and in our recommendations for the control of particular insects. By free discussions at these meetings much can be accomplished to this end."

The next object laid down is 'to give opportunity to individual workers of announcing proposed investigations, so as to bring out suggestions and prevent unnecessary duplication of work.' "This brings upon us the importance of systematic co operation in our investigations; it has been often urged upon us, but not much progress has been made. One of the chief difficulties is that each one wishes to plan his own experiments and publish the results, in order that he may not have to share honours with another. Such a feeling is not altogether to be condemned; neither is it necessary to so plan our co-operation as to make it essential to remove credit from him to whom it belongs. Let us suppose two entomologists are planning independently to test the effect of insecticides upon foliage. Each carries through his experiments and publishes the results of his labors. They are still independent experiments, the results of one not supporting or contradicting to any great extent the results of the other. Had each known what was being planned by the other, they could have arranged to carry out their experiments so that they would be largely duplications of each other, and when the results were published we should have double evidence upon the points under consideration where results agreed; and where they disagreed, we might be able to find in the different conditions the reason for it. Such a co-operation would bring results of far greater value than those obtained by independent experimentation, and neither party would lose any glory; in fact, each would receive more credit because of the better conclusions that could be drawn from the work. And then how carefully every conclusion would be reached and backed by positive proof for fear that the other party might get different results! Such duplication as this is of the utmost importance to establish scientific truth, and the more we can have of it the better. It is only the 'unnecessary duplication of work' that our constitution deprecates."

"It is frequently the case that one is working out with considerable care the life habits of an insect, and a little information from exact observations upon some particular point in other localities would be of great service to him. The person giving the information would have full credit for what he did, and the world would have the benefit of the combined results. When time can not be taken by the head of a department for this aid, it may often be the case that a special student in entomology would be glad to get his name into a bulletin for doing a little good work. I have a case in mind to illustrate. The speaker is working on the life history of the codling moth. His observations make him wonder how it can be possible that there can be so few as one brood or so many as three or four anywhere. He would be greatly aided if a few entomologists in different parts of the country would make the following observations and report results this year. First, obtain date of blooming of the earliest apple trees. Second, determine the time of appearance of the first moths of the second brood by collecting a few of the earliest wormy apples and rearing the moths from them. Third, determine when the brood of worms that go over winter without pupation begin to leave the fruit. This can be done by placing cloth bands on the trees about July 15th, and removing the larvæ that appear under them once a week until those have been taken that do not change to a chrysalis within a short time. Then, with the other facts that have been well worked out, it will be possible to state with considerable definiteness the number of broods in different portions of the country."

The speaker next referred to the importance of having at each Experimental Station as complete collections as possible of insects in all their stages that are serious pests, and said that the only way in which this could be accomplished was by a system of mutual exchanges. After speaking very briefly on the third clause of the constitution 'to suggest, when possible, certain lines of investigation upon subjects of general interest,' he went on to the last clause, 'to promote the science and advance the study of entomology.'

"The usefulness of any applied science depends upon man's knowledge of the natural laws operating in that science. An astronomer could not determine the very day, hour, and minute when an eclipse of the sun would be visible at a particular spot on the earth's

surface, or the exact date of the return of a comet, if he did not thoroughly understand the operation of the laws by which these marvellous phenomena are brought about. Neither can applied entomology accomplish its highest mission in the world for man's benefit until he succeeds in thoroughly working out and interpreting aright the laws which prevail in the insect world, and they are many and intricate, and some of them difficult of solution. Whatever we can do to interest others in the study of insect life, in any of its phases, to the end that new facts are recorded, will help to the more perfect understanding of our favorite science and consequently to its usefulness. We are greatly indebted to the pure systematist in entomology who never attempts to make a practical application of his knowledge."

"It would greatly promote the science of entomology if each member of this Association would make a special systematic study of some groups of insects, however small, and publish the result as a personal contribution to the pure science of entomology. We would be better workers in economic problems for so doing. A study of the habits of insects in nature's laboratory fits one for a grade of systematic work that he never could attain as a closet naturalist."

"A knowledge of food plants, of broods, of local variations, and of variations occurring among the offspring of a single pair, determined by careful observation in nature's haunts or by breeding in the laboratory, is as essential to enable one to establish true specific differences as is a thorough knowledge of structural character."

"To promote a science it is necessary to make known its relations to human interests. If men can be shown that their health, wealth, or happiness depends upon a knowledge of insect life, there will be no trouble to interest people in the study of entomology. Show the farmer, the gardener, and the horticulturist the importance of knowing the habits of insects in order to successfully combat the pests that destroy their crops; bring to the attention of the preacher the inexhaustible fund of evidence and illustration with which to teach his flock the power, wisdom, mercy, care, and omnipresence of the Creator of all; make known to the artist the boundless field which a study of insects opens to him for the display and developement of his powers in portraying graceful and fantastic forms and in preparing and blending colors of the most exquisite beauty and harmony; teach those that instruct the young what a wealth of interesting and easily obtained objects are always at hand from insect life with which to fascinate the child and secure his lifelong interest in natural history study; make it plain to all that the very laws of life that prevail in the higher realm are equally patent among the creeping, crawling creatures of lower rank and smaller size—do all this, and the science of entomology will quickly take the rank it deserves among its sister sciences."

"In closing let me urge that we keep in mind the worthy objects for the promotion of which we are banded together. Let us keep the standard of work up to the ideal conceived by those in whose minds the organization had its birth. Let us show a willingness to sacrifice self-interest when it is necessary for the general good, and let us do all in our power to preserve and strengthen the fraternal feeling that has ever existed among our members."

In a subsequent discussion of the address, Prof. Webster said that there were very many features in it of vital importance to working entomologists. One thing he considered entitled to especial emphasis and that was the matter of duplication of work. The fact that one member was working upon a given species in one State or Province and another member was working upon exactly the same species in another region of country, while apparently a duplication of work is not really so, because in all probability very different results would be obtained. No two men see the same thing in the same light, and climate, latitude and elevation also have a great deal to do with the action of insects. As to the matter of mapping out work, it must be remembered that most entomologists are limited in their powers, and, while they can plan work, it is not always easy to carry it out, as a station director or a board of trustees might greatly revise his plans. In regard to the introduction of foreign parasites, it seemed to him that it is a field we are just entering, with the future all before us, and there would be many failures; but where such work was carried out carefully he believed it might prove successful with respect to a great many introduced species of insects. When we come to carry it out between States, how

ever, other difficulties will surround us. He went to a great deal of pains to obtain from Professor Morgan an egg parasite of Murgantia, and after getting it established, it was swept out of existence during the winter of 1898–99, and no good has come from the introduction. He was also of the opinion that a great deal could be done by an exchange of experiences with insecticides, such as had taken place in the morning session, as insecticides seldom have the same effect in different portions of the country. It had always seemed to him that the work of the economic entomologist was very largely to work out life histories, and after he had done this and had found out methods that could be used to destroy the insect his duty ends and the work of the horticulturist and agriculturist begins. He did not think it ought to be necessary for an entomologist to make of himself a mechanical, hydraulic, or civil engineer.

Prof. Fernald referred to the remark just made by Mr. Webster to the effect that no two men saw the same thing in the same light, and said that the same was often true in listening to an address, for generally no two men got the same ideas from it. For him other parts of the address than those mentioned by other speakers had presented themselves with particular force, and especially those with reference to collections in connection with the insectary or entomological work of any kind. It seemed to him that the work of a station whether connected with a college or not, is most emphatically educational, for even if it be not educational to students or visitors, it is certainly educational to the workers at the station themselves, and by continually adding to such a collection they are adding to their education as well as to the education of the residents of the region. He had thus far found a great demand for collections rather different from those ordinarily met with. The ordinary collection contains the rare insects as frequently as it does the destructive ones, and by that he meant to uphold the question that was raised in the address with reference to how many of the common insects could be found in different collections. He suggested that, so far as his own experience goes, there are too few collections in which all stages are preserved in connection with the work that insects do. A large part of the material that he receives in Massachusetts does not contain any insect whatever, but simply a sample of the work of the insect which has either escaped from the box or was never inclosed. The problem in such cases is to tell what has done the damage by the damage itself. He found that his greatest help was to preserve specimens of the insect and of the work it was doing, and he used such specimens in the identification of material sent in, perhaps fifty times as often as any other specimens. Our collections, in his opinion, should be amplified along the lines of early stages and the work done by the insects, and such collections will appeal strongly to the people. The whole address was interesting and suggestive, but it was this feature which interested him most. He had also had experience with the Murgantia parasite obtained from Louisiana by the kindness of Mr. Morgan, and while he was now fortunate in not having Murgantia to deal with, it was a great relief, while searching around, to find that there was some one who could assist him, and he thought anything in that line should be encouraged, for when a man wants a thing of that sort he wants it badly.

Mr. Johnson said there was another important suggestion implied in the address, and that was the commercial side of entomology—if the term might be permitted. We have enough systematic entomologists at the present time, and perhaps enough economic entomologists, but we do need another lot of men who will take up purely the œcological side; that is, they must study conditions in the field. The day is coming, and is not far distant, when our great commercial railroads and some of our greatest manufacturing concerns, such as canneries, will employ œcological entomologists just as they employ engineers and other skilled labor. He felt quite certain that this would come about, and that a new field would open to young men especially, who would take up this commercial side of the entomological problem. To give an illustration of what he meant, he said he would try to bring this out in a paper which he would read on the following day on the subject of the pea louse in Maryland, which has destroyed more than $4,000,000 worth of green peas along the Atlantic coast this season.

When insect injury touches the pockets of the producers to that extent they are going to look about for the men who have a knowledge of the insects. It means money to them. He had been in consultation with some of the high officials of one of our principal railroads, and felt certain that the day is not far distant when these roads will employ men to take up the entomological study and development of the territory through

which their lines run. He considered this an important point for the student of entomology to bear in mind. Of course such a man must go out and study conditions over a vast area. He must also know what our worthy chairman is doing in Colorado; what Mr. Weed is doing in New Hampshire; what Mr. Lounsbury is doing in South Africa; what Dr. Fletcher is doing in Canada—in short he must keep posted on the entomology of the whole world and be ready to meet any emergency.

Prof. Hopkins said that he found in the spruce forests of Maine that a large timber concern controlling some 300,000 acres employed a practical forester and scientific man, and paid him about $1,500 a year, to give advice on practical methods of cutting timber and making surveys. The concern mentioned sent this man with the speaker through the spruce forests of Maine to learn all he could about forest insects. This was another evidence of the fact that the practical men are beginning to realize that they can very profitably make use of the results of scientific research.

A vote of thanks to the chairman for his interesting and suggestive address was unanimously adopted.

Dr. L. O. Howard, in the first paper, detailed the operations performed in the introduction and establishment of the *Blastophaga* in the fig plantations of California, which had been carried on since the last meeting. The paper will be published in full in the Year-book of the U.S. Department of Agriculture for 1900.

Establishment of a New Beneficial Insect in California.

A second note presented by Dr. Howard also related to the introduction of a beneficial insect. He stated that it would perhaps be remembered that at the tenth annual meeting of this Association he had referred to his efforts to introduce and establish in this country, with the assistance of Prof. Antonio Berlese, of Italy, the interesting Oriental parasite known as *Scutellista cyanea*. In Italy this curious parasite occurs commonly in the wax scale (*Ceroplastes rusci*), and it was introduced into Italy in all probability from the Orient about forty years ago, although originally described by Motschulsky in 1859 from specimens reared by Nietner in Ceylon from *Lecanium coffeæ*. The living specimens were sent by Dr. Berlese and his colleague, Dr. Leonardi, and were colonized at Baton Rouge, La.; also in Washington D.C., in the insectary of the Division of Entomology upon *Ceroplastes cirripediformis*. The Washington specimens did not succeed in perpetuating the species and nothing has been found since of the Louisiana material. A year later Mr. C. P. Lounsbury, government entomologist of Cape Colony, found this species parasitic upon *Lecanium oleæ*, the common black scale, in Cape Colony, and sent specimens to the writer for identification. The past spring, Mr. Lounsbury, at the writer's request, made formally through the United States Secretary of Agriculture to the Secretary of Agriculture of Cape Colony, brought with him from Cape Town to New York two boxes of twigs covered with the black scale affected with this parasite, and expressed them to Washington, whence they were immediately forwarded to Mr. E. M. Ehrhorn, the horticultural inspector of Santa Clara County, Cal. On June 19 the writer received a letter from Mr. Ehrhorn announcing the arrival in living and healthy condition of the parasites in question. The twigs in one box were somewhat mouldy but quite a number of parasites were crawling about in the box and were found in the pupal condition in some of the scales. Mr. Ehrhorn had been warned by telegraph and had prepared twenty-five infested oleander plants by potting them and had covered each with a tight bag of the finest Swiss muslin. In these most of the parasites were liberated and a few were allowed to fly in the orchard. Specimens of a hyperparasite (*Tetrastichus* sp.) also survived the journey, but Mr. Ehrhorn was on the lookout for this parasite and isolated them as they appeared, pending instructions from Washington as to their destruction. The writer had strong hope of the successful establishment of this species at San Jose, the climate being appropriate and the supply of food unlimited, and stated further that this was another instance of international entomological work which emphasized the fact that this Association through this class of work binds together its members all over the world more than any other association.

At the opening of the discussion on the paper, Dr. Howard said that he would be glad to hear from Mr. Lounsbury on the subject of this parasite of the black scale. He

said he wished to add that Mr. Lounsbury had sent two boxes, one a deep box and the other a shallow one. The shallow box carried the more successfully; the scales had begun to rot in the deep one.

Mr. Lounsbury stated that the history of the case dated back to his first arrival in Cape Colony. Before he had been there a year he noticed that the black scale was not injurious, and upon travelling about the Colony he found the same condition true over many thousand miles of territory. Later, upon obtaining specimens of the parasite and corresponding with Mr. Howard on the subject, the latter had suggested his sending it to California. For four years he had been watching for an opportunity to get a sufficient number of parasites to send, but the scale is so well kept in check by the parasites or by other factors, that until this year he was unable to find a large quantity. Last year he mentioned the matter in his annual report; a copy of which he had sent to Mr. Ehrhorn, who at once wrote and asked him to take steps to get the parasite established in California. He replied that he would gladly do all he could, but would like Mr. Ehrhorn to make it a formal matter so that he might be able to spend the time and money necessary. This was done and Mr. Lounsbury received formal orders to go ahead. He set about it in two ways: First, he had scales collected and reared young larvæ from them, which were placed on young oleander trees now being kept in the Cape Town gardens. Primary parasites were to be admitted to the plants, but secondaries excluded. These plants in time he may be able to send to the United States in Wardian cases. Second, while waiting for these to develop he had Mr. Mally go out and search the country side, with the fortunate result that relatively large colonies of scale were found where Mr. Lounsbury had seen small colonies the year before. Mr. Mally collected for nearly a week and brought in over a bushel of twigs which were carefully sorted, cut into foot lengths, and the ends dipped into sealing wax. The twigs were then wrapped in tissue paper. The matter of the differently shaped boxes was purely accidental. He went to the grocery shop and picked out what he thought would be best suited, taking one shallow box and one deep box in order to try them. He thought that packed in the manner above described and placed in a wooden box, what moisture came would be absorbed by the wood. The boxes were packed the night preceding Mr. Lounsbury's departure, the deep box being placed on a dry shelf in the fruit room of the Cape steamer and the shallow box kept in the stateroom. In this way the insects were taken to England, which he hurried across and took the next liner. He then tried to get the box which he had kept in the fruit room also placed in a cool room on the New York steamer, but found no choice between putting it in the meat room or leaving it outside. He preferred not to freeze the insects because the parasites, not being accustomed to such temperature, might succumb, and he therefore placed the box in an empty cabin below the water line. The voyage was fortunately cool, the temperature averaging about 60°. The shallow box was kept in his stateroom, as on the Cape steamer, and immediately upon arrival in New York both boxes were shipped to Dr. Howard. They arrived in New York in 25 days from Cape Town, a quick passage which, perhaps, could not be repeated.

On being asked if the black scale in South Africa is destructive to citrus trees to the same extent as in California, Mr. Lounsbury replied that he had seen citrus trees infested in only about ten places in the last five years, and never more than a few scales at any of these places. Occasionally he had seen the scale on citrus trees from Natal or from Australia which had been imported to the Cape. One orchardist having several thousand trees, said he had seen a few on his Australian trees, but they had disappeared. He himself was unable to find any there after a year from the importation. It is not known of what country the scale is a native, but it must have been in Cape Colony for many years. It occurs most commonly on oleander, which at the Cape is an outdoor plant, and Myroporum. He had found it 150 miles inland and on numerous indigenous plants away from settlements.

Transmission of Parasites.

A conversation on the subject of the transmission of parasites from one region of country to another then followed. Mr. Johnson said that he had recently received a request from Mr. Ehrhorn of California, for parasites that prey in the East on the imported cabbage worm. It seemed to Mr. Johnson that this was a matter for co-operation,

and he merely mentioned the fact as a suggestion from Mr. Ehrhorn that it is very desirable to establish such parasites in that section. He had promised to do what he could from his end of the line, and he hoped that others who were fortunate enough to possess such parasites would also assist. He had also received a request from Professor Morgan for specimens of the parasite which he had bred and which Mr. Howard had named. Professor Morgan is anxious to colonize this parasite on *Murgantia histrionica* in Louisiana, and Mr. Johnson had promised to send him parasitized eggs of the harlequin cabbage bug at the earliest opportunity, but up to the present time had been unable to find any specimens of this destructive pest. Three years ago it was one of the most destructive insects in the Maryland and Virginia cabbage-growing sections, but since the freeze of February, 1899, he had seen very few specimens. He was unable to say whether this was due entirely to the freeze or to the parasites. The parasite is a new species (*Encyrtus Johnsoni* Howard, Can. Ent. Vol. XXX, pp. 17, 18) and there seems to be some promise of its successful introduction into the South.

Mr. Gillettte said he considered the matter of parasites one of great interest, and he hoped the subject would be further discussed. In Colorado nature often seems out of balance. There are a number of species which are not abundant in the East, but which are very injurious in Colorado, and he thought it was because the parasites have not been carried to that section of the country. In his opinion it would be of the greatest benefit to certain portions of the country to introduce insect enemies, both parasitic and predaceous.

Dr. Howard said he desired to call the attention of the members of the Association to the fact that this was the most representative meeting of the Association ever held. Not only was Mr. Woodworth, of California, present, with Mr. Fernald, of Massachusetts, Mr. Weed, of New Hampshire, and Messrs Quaintance and Scott, of the Southern States, but also "our dear old friend," Mr. Fletcher, of Canada, and Mr. Lounsbury, who had carried American economic entomology clear across the Atlantic Ocean to South Africa. Mr. Currie, the under secretary of agriculture for Cape Colony, who was recently visiting Mr. Howard in Washington, had said that he was very glad indeed that he had sent for an American entomologist to come to the Cape, and congratulated his department upon being able to secure such a man as Mr. Lounsbury.

Dr. Howard presented a third note in which he gave an account of the useful work performed by the larvæ of a little lady-bird beetle, *Hyperaspis signata*, in destroying the scales on maple trees, *Pulvinaria acericola*, and also those of *P. innumerabilis*. These larvæ very much resemble the scales on which they feed.

Mr. E. P. Felt, State Entomologist of New York, read a paper on

Some Effects of Early Spring Application of Insecticides on Fruit-trees.

He said that a series of tests had this spring been begun near Albany, N. Y., with the object of ascertaining the best method of controlling the San Jose Scale in orchards. During the progress of the work trees were treated with mechanical mixtures of water and kerosene, and of water and crude petroleum, using 20 and 25 per cent. of the oils and applying with a kero-water sprayer. A few trees were treated with undiluted kerosene and others with undiluted crude petroleum; a number of trees were also treated with caustic potash whale oil soap, at the rate of 2½ lbs. to a gallon of water, and some with a combination of the soap and crude petroleum in the proportion of one pound of soap to four gallons of water, and one gallon of the oil to ten gallons of the soap solution. The spraying was mostly done on April 11th and the work was performed in a mixed orchard of over 100 young pear, peach, plum and cherry trees, where the San José scale had been for about eight years, and the trees, therefore, presented every degree of infestation. The undiluted kerosene and crude petroleum were applied to the worst infested trees.

The spraying with the insecticides occurred just before the buds began to open, and with the exception of the trees treated with the undiluted oils very few or no harmful effects were observed. Eight days after spraying, the trees as a rule were budding out. Those treated with kerosene gave little indication of the presence of the oil on the bark, while the dark colour of those treated with crude petroleum was very apparent, a condition which still continues at the time of writing, June 20th. The whale-oil soaps showed to a considerable extent. Photographs were exhibited showing the harmlessness of

mechanical 20 per cent. emulsions of either kerosene or crude petroleum, also of similar 25 per cent. emulsions. Other photographs showed positive injury from the use of undiluted kerosene, and most marked injury from undiluted crude petroleum; one plum tree was killed outright by the latter treatment.

Experiments undertaken in other localities also served to show that crude petroleum may seriously injure trees under certain conditions. The trees may eventually outgrow the harm, and it is possible that the injury may be no greater than the scale would have caused, if allowed to go unchecked. The mechanical dilutions of crude petroleum, at least up to 25 per cent., appear to be harmless if applied before the buds are open, and it is to be hoped that they will prove effective in controlling the scale.

A general discussion followed the reading of Mr. Felt's paper. Mr. Scott said that in Georgia undiluted crude petroleum killed peach and plum trees outright, but 50 per cent. and less strength did very little damage. The best results were obtained with 25 per cent. in mechanical mixture with water sprayed with a Gould kero water sprayer. The application was made just before the fruit buds opened in the spring; all the insects reached by the spray were killed, according to notes made up to June 12. Until that date the sprayed trees remained oily and the odor of the crude petroleum could yet be detected. It is a reasonable conclusion, then, that the scale can not live so long under such a coating of oil. He had concluded that the 25 per cent. crude petroleum in mechanical mixture was better than refined kerosene of the same strength.

Mr. Woodsworth said that when the bulletin from the New Jersey station came out it was heralded all over California, and he had to write more letters in regard to the kerosene and crude petroleum treatment than about any other insecticide. Crude petroleum in California is a very indefinite term, since there is a crude petroleum from Ventura which is as thick and black as molasses, and from that it varies to crude petroleum which is almost as thin as gasoline. Even in a single well the product varies according to depth and age, and distillations show that it varies greatly in composition. He had been assured that the Eastern product varied also, and was of opinion that before we can recommend any percentage of crude petroleum we will have to establish a criterion of excellence. The different kinds of crude petroleum he had experimented with in California produced very different results—strikingly different. There is also a very decided difference in results according to time of spraying with the same oil. Thus spraying before rain and after rain may produce entirely different results. He had sprayed with some forms of crude petroleum without injury which would have thoroughly destroyed the foliage at another time of day. The amount of water in the leaf may determine to a certain extent the damage by the oil. It seemed to him, therefore, that another thing that must be done before we can really properly understand the action of the oil will be to study the effect of the oil upon the vegetable tissue. Perhaps this had already been done, but it was still in large part a mystery to him.

Mr. Webster said he had used oil from two wells located in different parts of Ohio this year, and although the analysis ran almost exactly the same in each case the effect has been different. In the one case he had not seen the orchard for several weeks, but when he last saw it the peach trees seemed to have been in many instances killed by the use of crude petroleum. He could not say whether the oil had been applied just before or just after a rain. In the other case the trees sprayed were seedling apples on the experiment farm, the experiment being made to determine if possible the effect upon the trees and not against insects. Some of the trees leaved out at the proper time about as freely as usual, while others had no leaves at all. At the present time, however, there was no apparent difference whatever in them, all having finally leaved out precisely the same. It was evidently nothing but a temporary injury. His experiments had produced such various results that he was badly mixed up and did not favour recommending the use of kerosene of any sort. He was of the opinion that the variation would be just as great in the crude article as in the refined.

Mr. Hopkins said that in West Virginia they have a great variety of petroleum, from that as thick and black as molasses to the thin light-coloured product. The oil obtained from the Standard Oil Company is a mixture of all kinds except the heavy oil. The heavy oil is used for lubricating machinery. He had obtained some results which are quite at variance with the testimony of others and show what conflicting results can be obtained in different States. In one case he recommended crude petroleum as an experi-

ment in a large orchard which was almost dead from the scale and which the owner refused to cut down. It had been sprayed once with pure kerosene, which did some damage and killed many scales, but the owner had allowed it to go without treatment and the scales had again covered the trees. He sprayed it with crude petroleum obtained in Baltimore. When he last saw the orchard, in April, the trees were black and greasy, but underneath the bark they were as healthy as ever, the leaves were coming out in full, and the owner claimed that the crude petroleum had benefited them. He was not recommending the oil, but simply giving this as an example. His spraying was done in February and wherever the oil touched the bark it remained dark and greasy for months afterwards. A thorough examination failed to reveal any of the living scales, and he believed that the young scales could not settle and live on the oily surface. He felt very much encouraged. It is one of those problems which require co-operative work. As a result of further investigation, he thinks it may become one of the best insecticides ever discovered. He could not think of any better work than trying to find the reasons for the great difference in results in experimental work with insecticides.

Mr. Webster said he was unable to see what could be gained even if crude petroleum should be perfected. It was true that we will have to get something cheaper and more effective than whale-oil soap, which if used on peach trees except during the winter will destroy the fruit, but in view of the difficulty he had had in getting crude petroleum and the high price asked for it, how much better an insecticide than whale-oil soap would we have even if it was perfected? He thought that entomologists who cared for their reputation would experiment much and say little for publication, for the present at least. He further stated that while experimentation was always in order, it would be best to stick to the whale-oil soap until more obscurities in regard to the use of petroleum had been eliminated.

Mr. Johnston said he agreed with Mr. Webster. We have got to get something better than kerosene for both peach and plum. In one instance he had sprayed an orchard of two hundred 9-year old peach trees in February with 25 per cent. kerosene and not a tree was living on the 28th of April last. It seemed to him that atmospheric conditions were at the bottom of the difficulty, and he thought it would be necessary to go back to the old whale-oil soap remedy, which destroyed the scale more effectively and was less liable to injure the trees. It would not be wise to substitute crude petroleum for whale-oil soap. After three years experience with the soap, kerosene and gas, he was of the opinion that there are other conditions which must be studied more seriously in the future than in the past, and he heartily agreed in the opinion that co-operation is desirable. He believed it would produce better results in the future. We must not confine our labours to the territorial boundaries of a State, but go outside for information, suggestions and experiences of others.

Dr. Fletcher remarked that he was glad to hear what had been said about whale-oil soap and crude petroleum. He had never yet been able to see what object there was in trying to use petroleum. The results were far too conflicting and always unsatisfactory, and the question of cost in the ruin of apparatus was never considered. There was very slight injury to the hose in the use of potash whale-oil soaps, which could now be obtained of pretty uniform manufacture and had been giving good results. These are always to be had, and are easy to get in most places, while he had found great difficulty in getting crude petroleum. He thought there was room for experiment with much weaker mixtures of the potash soaps during the summer. His experience was in favour of these soaps in preference to either crude petroleum or kerosene mixed with water. Even with the kerosene emulsion there is sometimes unexpected injury to the trees, which was always put down to difference in the oil or in the water. He was satisfied for the present that the whale-oil soap was the safest remedy, and it was the best for those who are official entomologists, who have to recommend formulæ to people who will make a mistake if they possibly can.

Mr. Sanderson related his experience with crude petroleum, which was favourable to its use. He had sprayed a pear orchard on the Delaware river with it in the latter part of January, on a cloudy day, followed by a little hail and rain soon afterwards. Two months later he sprayed another lot of 100 trees with a 25 per cent mixture; it was a very windy day and almost all the trees previously sprayed got a dose of the 25 per cent.

mixture on one side. Examination shows no injury on either lot. Here and there could be seen a tree not doing well, but that was owing to the spray of a year before with pure kerosene. The buds were not injured. The growers in his region never use whale-oil soap, because it destroys the buds. They have used it during midwinter and it destroyed buds, and have now given it up.

Mr. Woodworth said that he did not wish his former remarks to be construed to mean that there is no future for crude petroleum as an insecticide, but he desired to emphasize the fact that there is a great deal to learn. In some of the large orchards in California crude petroleum has been used with success, but not against the San Jose scale. He is of the opinion that there is a great future for crude petroleum, and that the time will come when it will be cheaper in the East. In California it is the cheapest insecticide that can be bought.

Three papers were read by Mr. Clarence M. Weed on "The oviposition of an egg parasite of Vanessa antiopa"; "The oviposition of Cacœcia cerasivorana," and "The relation of Pimpla conquisitor to Clisiocampa Americana." The last-named insect (*Pimpla*) is the most important parasite which attacks the pupa of the apple tree tent-caterpillar.

Hydro-cyanic-acid gas.

The reading of a paper by Prof. Fernald on "The Marguerite Fly," which he has retained for publication elsewhere, led to a discussion regarding the use of hydro-cyanic acid gas.

Replying to a question from Mr. Johnson, as to whether hydro-cyanic acid gas had been used, Prof. Fernald stated that there was objection to the use of this substance among florists, who have an exaggerated idea of the danger involved and will not often use it. He had no doubt hydro cyanic-acid gas would be more effective, but thought the florists would prefer to use carbon bisulphide, as this substance had proved satisfactory.

Dr. Fletcher thought that remedial work against the flies during the winter would be better than work against the larvæ after they have eaten the leaves.

Prof. Fernald replied that the problem had been thus far looked at by him entirely from the florists' standpoint, and the insect treated in the stage at which the florists would first see it and want to treat it. He was certain, however, that the fly could be handled by fumigating the greenhouses.

Mr. Johnson stated that one could not be too careful in the use of hydrocyanic-acid gas, and he wanted to caution all those who used it. In one instance, after preparing the chemicals necessary for generating the gas, he thought he would take his chances in dropping the cyanide in the jar and get out, but he felt the effects of the gas almost immediately. By the time he reached the door a haze came over his eyes, everything looked black, and a feeling similar to blind staggers overcame him. Experience has proved that it is not a trifling matter, and he would caution all who had occasion to use the gas. At the same time he felt that hydrocyanic-acid gas was the coming material for the destruction of certain insect pests in mills where stored grain and other products become infested. He had recently performed one of the largest experiments ever undertaken in the use of hydrocyanic acid gas, in a five-story brick mill in Canada. Over 150 pounds of potassium cyanide was discharged in the mill, and the results were very gratifying. It practically eliminated the flour moth from the mill.

Dr. Fletcher said he did not think enough care could be taken in giving instructions when recommending hydrocyanic-acid gas for general use, especially in this stage of introducing it, as a fatal case or two would put an end to its use entirely. Several striking instances had lately been mentioned which show the intensely poisonous nature of this gas. Much more care, instead of less, than has been exercised in the past is necessary. With regard to the use of bisulphide of carbon, he certainly was not satisfied with its use in mills and had not got the results promised for it. He was very sorry Mr. Marlatt was not present at the meeting, as his laisser-faire policy had given him a lot of trouble with the people he had to deal with, and he was of the opinion that some others of the Association might have liked to discuss that matter somewhat.

Mr. Webster stated that his fumigating houses in Ohio are covered carefully and made perfectly air tight by the use of layers of building paper, but if the ordinary nurseryman makes his own fumigating house he would not make it any more air-tight

than a hencoop. He had tried almost every way of introducing the cyanide, but the man who did the work invariably complained of severe headache, until he devised a method of combining the mixtures under the floors.

Mr. Lounsbury suggested that a simple way was to have a small lead tube leading from the outside of the house, the vessel containing the cyanide being placed under the tube, the door closed and locked, and the water and acid freshly mixed being poured in through the little funnel or tube and the aperture closed.

Mr. A. L. Quaintance of the Georgia Experimental Station, read the next paper on *Diabrotica 12-punctata* which is a serious pest to corn in the Southern States. The injury to the plant is confined almost entirely to the work of the larvæ on the underground portions of the plant, as the roots and stem below the surface of the soil. The attack is mainly in the spring while the plants are quite young. The writer gave an account of the life history of the beetle and the experiments that had been made with a view to its control. He found that if eight to ten grains of corn be planted in each hill, the plants would not all be destroyed, and the injury from this Southern corn-root worm would be practically avoided, or so distributed that the damage would be trifling.

Mr. C. P. Lounsbury gave a long and very interesting account of his observations on the habits and associations of a number of species of Ticks that cause great annoyance and much injury to live stock in South Africa.

Mr. W. M. Scott presented a paper on the Coccidæ of Georgia in which he enumerated 41 species of scale insects that he had found in the State, and gave their localities and food-plants.

On Saturday morning, June 23rd, the Association met in joint session with the Society for the Promotion of Agricultural Science, the President of which (Prof. Beal) read his annual address. Dr. L. O. Howard gave an account of the progress of Economic Entomology in the United States, which is published in the year-book of the U.S. Department of Agriculture for 1899; and Mr. C. P. Gillette read a paper entitled "Apiary Notes."

NOTES UPON THE DESTRUCTIVE GREEN PEA LOUSE FOR 1900.

(*Nectarophora Destructor*, JOHNS).

By W. G Johnson, College Park, Md.

Perhaps no insect in recent years has attracted more attention than the destructive green pea louse. It became conspicuous, first, on account of its ravenous attacks upon the pea fields, a crop heretofore practically immune from the ravages of insects; and, secondly, from the fact that it was a species not recorded in science. What condition in nature was responsible for such a general distribution of a new species of insect the writer will not attempt to discuss in this short paper. It appeared last year, and was recorded for the first time, from Maine along the Atlantic coast southward to North Carolina, and westward to Wooster, Ohio. It was also observed in Nova Scotia and Ottawa, Canada. I had it sent to me from Massachusetts and Vermont in July and August, and complaints of its serious nature have come to me from Chillicothe, Ohio, Long Island, N.Y., portions of New Jersey, and Wisconsin (August). I first observed the pest May 18, 1899, and have had it under constant observation from that date to the present writing. I described the newcomer in the February issue of the Canadian Entomologist as *Nectarophora destructor*. A very long name, I admit, but if there is anything in a name being a burden to its possessor, we hope that this one will accomplish such a purpose.

From the first I have held that this insect is probably a clover pest. It has been observed upon both red and crimson clover, and this season hundreds of acres of red clover have been destroyed by it. In one instance, reported to me June 13, Mr. C. Silas Thomas, of Lander, Frederick County, Md., stated that the pest had almost entirely ruined 65 acres of red clover for him. Many other cases of a similar nature were reported or observed by us. The attack has been very common upon crimson clover also, but I have not heard of a field being killed by it. That clover, and perhaps the red clover, is

its original food plant seems quite conclusive from our experiments and observations. I am of the opinion that red clover is its original food, and that it is, therefore, primarily a clover pest. Without doubt it is a native American insect, and has spread its attacks to crimson clover and field peas, as these two plants have encroached upon the feeding ground of the louse. It spends the winter, at least in the South, as an adult in clover fields. It may winter in another form farther north.

It is barely possible that this insect has other food plants and lives over winter upon them, but clover is, no doubt, the main plant upon which it lives. Mr. F. H. Chittenden, of the U.S. Department of Agriculture, Division of Entomology, in Washington, observed this insect, or one very closely allied to it, feeding upon a number of species of vetches in Washington this year.

From a long series of experiments in the laboratory we have shown that there are two kinds of females known at present, the winged and wingless forms. No male has as yet been discovered, and perhaps in the South none exists, and the insect remains over winter in the adult stage, as stated above, upon some plant, and in most instances this is clover. The female produces living young which reach maturity in from ten to fifteen days, and possibly less time in hot weather. As an example, a young one born March 4 reached maturity (winged form) March 16, or 12 days from time of birth, and was producing living young on March 19. From that date to April 17 it became the mother of 111 young and then died. Her first young (wingless form), born March 19, reached maturity and was producing on March 31, or eleven days from time of birth; from that date to April 13 she gave birth to 120 young and died. We have made many other observations of a similar character, but this will suffice to show the rapid reproductive powers of this insect, and we might state that in many instances where this insect was first observed on May 1, three weeks later the fields were abandoned on account of its attacks. Calculated from the average number of insects produced per day (which is 6), in six weeks one would become the progenitor of 423, 912.

It was estimated last year that the total loss from the attacks of the creature along the Atlantic Coast States was $3,000,000, and that the crop was only one-half the usual output. From information obtained from the largest growers, the most experienced seeds men, and most extensive dealers in this line of business, "The Trade," a canned goods journal published in Baltimore, has gathered the information that the crop of peas of the Atlantic Coast this year will not exceed, on the outside, one-third of what it was last year. This is about as serious as it can be, when it is taken into account that it is mostly due to this one pest, and that it is certain to increase its destructive powers from year to year, unless some factor in nature intervenes to check and retard its further development. With this condition of affairs it is not strange that farmers have become thoroughly discouraged and make the statement that they will be more cautious about planting peas for market purposes, or for the packer, in the future.

With this year's experience, however, we have shown conclusively in our experiments and practical works in the field that this insect can be kept in control to a very great extent if taken in hand in time. In the first place, the peas must be planted in rows 24 or 30 inches apart, and not broadcast or in drills, as has been the case over a wide area throughout many of the Southern States. As an illustration of this we may cite an instance on the place of Mr. C. H. Pearson, a large packer of Baltimore. His 600 acre pea plantation was practically saved by persistent and energetic efforts on his part this season. All the methods from a practical standpoint were tried on this place, and it was found that the brush and cultivator method was the most effective. Forty men were therefore engaged to work in the field, and the 600 acres were brushed and cultivated every third day for a period of two weeks, and in this manner the entire field was saved, netting the owner from 25,000 to 30,000 cases of peas of 2 dozen each. It is a fact which is not questioned by those who are familiar with this plantation that had not this persistent and energetic fight been followed, the greater portion of the peas would have been destroyed by the insect. Last year the peas over the same area were broadcast so there was no opportunity of fighting the pest, and as a consequence 480 acres were entirely ruined by it. This year, by changing the method, and by a new system of fighting the pest, the peas have been saved. Many other illustrations of a similar nature could be given where we have been following this method persistently in this State.

The brush and cultivator method is a simple one; a good pine switch is used to

brush the vines backward and forward ahead of the Iron Age cultivator, drawn by one horse, and in this manner the insects are covered and a very large proportion of them destroyed. The cultivation should not be repeated until the third day, as it requires usually something over forty-eight hours for the destruction of the adult insects when covered with earth. On this plantation we also sprayed a large acreage to show the practical side of this work. Suffice it is to say that we have found that no spray can be used which can destroy a percentage of insects large enough to warrant the expense of the operation. In this instance we sprayed 100 acres in two days, and thoroughly tested the method from every standpoint, using various materials. We abandoned the spraying apparatus, and began the brush and cultivator method, which was followed up persistently, with the results already noted. We have also used the "brush and pan," in which a bushel of lice were caught to each row of 125 rods long.

Many natural enemies, such as parasitic and predaceous insects, have been found feeding upon this pest in the fields, and in this manner, no doubt, the number has been somewhat reduced The most important factor, however, we have observed in the destruction of this pest has been the fungous disease, *Empusa aphidis*, which was common during the early part of the season upon this insect, in both clover and pea fields. It is a contagious disease and destroys the pest in very large numbers, under certain conditions. In one instance we found 58 dead lice upon the undersurface of a single lobe of a clover leaf, and it was not an uncommon thing in June to find 15 or 20 dead lice upon the under surface of a pea leaf. With the rains which prevailed throughout this section of country during June, which fostered the developement of the disease, it spread rapidly throughout the infested fields, and as a consequence it was very difficult to find the pea-louse upon late peas. A careful examination of peas where the insects were abundant in June showed that they were practically free from them. We feel, therefore, that the climax, as far as the development of the insect this season, has been reached, and that these silent factors in nature are now actually reducing the pest to such a point that it may possibly be several years before it will be such a destructive pest in this section as it has been for the past two seasons. At any rate, the conditions are such that the farmer and canner have new hope, and we trust the future will bring fewer lice and more peas.

In discussing the paper, Prof. Hopkins enquired whether the insect were possibly an introduced species, and if there were any records of its previous occurrence in large numbers.

Mr. Johnson replied that, in his opinion, it was not an introduced pest, but an indigenous insect, which had multiplied enormously from the change of conditions. The only record he had regarding it was one made ten or twelve years ago by Mr. Beckwith at the Delaware station, and another of its occurrence along the Potomac River in 1887. In neither case, however, was it certain that it was the same insect, as no specimens had been preserved. The pea-growers state that the insect has been known to them for many years.

Prof Hopkins said that this case is such a complete parallel to the invasion of the pine-bark beetle, the trouble from which is now over, that it occurred to him that in this case, within the next few years, this insect will probably disappear or become exceedingly rare. He had taken the trouble, in connection with the investigation of the pine insect, to look up the history of invasions by indigenous insects, and found that they multiply rapidly for several years, become enormously destructive, and a few years later disappear. They are destroyed by parasites or by climatic conditions and soon become rare species. This happened in the case of the pine insect, which was scarcely heard of before, and was one of the rarest insects in collections until it suddenly occurred in 1891 in such enormous numbers as to destroy millions of dollars worth of timber, but now it is practically extinct. Not a single living specimen has been found since the fall of 1892. Prof. Johnson's paper shows the great importance of the work he has undertaken, and his experience will be of inestimable value in dealing with future outbreaks of the pea louse. He thought the farmers of Maryland would make a great mistake by changing their locations for growing peas until perhaps a year had elapsed, because if the rule follows in regard to sudden invasions by indigenous insects they will soon disappear or become rare.

Mr. Johnson said he was greatly obliged to Mr. Hopkins for his opinion, but there is so much money at stake that the growers could not let the matter rest awaiting nature's

relief. He believed fungous diseases, especially *Empusa aphidis*, are one of the factors which will bring about the temporary disappearance of the pest.

Mr. Galloway said the point in regard to the appearance and disappearance of forms holds good in fungous attacks also, the most striking example being the potato blight. The same holds good in the passing of the Russian thistle. These things come and go and come again, and the principle holds good with fungous diseases as well as with insects.

Papers were read by Mr. B. T. Galloway on "Progress in the Treatment of Plant Diseases in the United States," and by Prof. Webster on "Meteorological Influences on the Hessian Fly." These were retained for publication elsewhere. The meeting then adjourned to the Central Park to inspect Mr. Southwick's spraying outfit.

On reassembling in the afternoon an elaborate and valuable paper was presented by Messrs. E. D. Sanderson and C. L. Penny, of the Delaware Experiment Station, on "Hydrocyanic Acid Gas as an Insecticide on Low Growing Plants." The results of their experiments proved that this method of treatment is practicable, but, owing to its cost, only for plants of some considerable value and for relatively small areas. Under many circumstances it could be used to much better advantage than any other means of combating a pest, and often might be found effectual where no other method of extermination were possible.

Mr. Sanderson then presented a paper, "Notes from Delaware," in which he reported upon the most noticeable attacks of the year in that State, and dwelt particularly upon the destructive green-pea louse, which had already been under discussion. After giving an account of the various parasites which preyed upon the insect, he said:

"The enemies of the lice appear too late to prevent the bulk of the injury, and as the same was true last year, it seems impossible to place any dependence upon them. It seems evident, however, that the lice are attacked by a parasite while still in crimson clover (parasitized lice were also common on red clover), but are not parasitized until they have been on peas for some time. Is it not possible the sudden appearance of the lice last year may have been due to the severe winter, which killed off the parasites and other enemies which usually hold the lice in check on the clover and so reduce their numbers that but few of them spread to peas?"

"The very sudden appearance of this new species last year was a unique entomological surprise. Where it came from was a question. It would seem to me that the original food plant of the pest was clover and probably crimson clover. It is true that crimson clover is not grown in the North where the louse was found destructive last year, but it is entirely possible that it may have spread from sections in which crimson clover is grown to red clover in these localities, but have been held in check by its parasites, and remained unnoticed. Furthermore, the insect enemies of red clover have at various times received study without this species having been previously noted. On the other hand, there seems to be good evidence that the louse has been on crimson clover for several years. One of our best farmers, Mr. Frank Bancroft, of Camden, Del., tells me that he has seen what he judges to be the same louse on crimson clover for at least six or seven years. In 1890 crimson clover grown upon an experimental plot at the Delaware Station became so badly infested with a plant louse that it was feared it would be killed. Professor Beckwith's notes state (May 11, 1890) that these were exterminated by a fungous disease, and the clover was not seriously injured. Upon looking over the station collection I found specimens of *N. destructor* which unfortunately were without any label, but were among material which was unquestionably collected prior to 1896. Upon corresponding with Professor Beckwith he informed me that he distinctly remembered preserving specimens of the aphis in question. As his accession catalogue shows no such specimens to have been numbered, though by no means conclusive, the evidence is at least strongly circumstantial that *Nectarophora destructor* occurred in injurious numbers on crimson clover as early as 1890."

"As regards remedies, I have practically nothing new to offer. It evidently is important to plant crimson clover as far from peas as possible, and to turn it under as early as practicable."

APHELINUS FUSCIPENNIS AN IMPORTANT PARASITE UPON THE SAN JOSE SCALE IN EASTERN UNITED STATES.

By W. G. Johnson, College Park, Md.

For the past eight years the writer has been paying particular atttention to the parasites attacking scale insects. During this period many species have been bred, but not many specimens from any particular scale. The instance cited below is, perhaps, the most important from the economic standpoint yet discovered in these observations.

Since we assumed charge of the State work in Maryland we have collected the San Jose scale on various food plants, and inclosed infested twigs, about 4 inches in length, in glass cylinder tubes open at both ends. The ends were closed with cotton, and if any parasites existed upon the scales they were easily detected and mounted for study. Only upon rare occasions have we taken more than a half dozen specimens from a single tube. This experience has been repeated year after year until the fall of 1899.

Of the four species of true parasites known to feed upon the San Jose scale, three of them have been bred in Maryland. So far as I know *Anaphes gracilis* How., bred by Dr. L. O. Howard from scales from Charles County, Md., has not been reared from this scale from any other State. *Aspidiophagus citrinus* Craw. has been reared only in California from this pest. *Aphelinus mytilaspidis* Le B. and *Aphelinus fuscipennis* How. have been reared from scales taken at the following places in this State: Riverside, Annapolis Junction, Araby, and Mitchellville. Last fall, however, I discovered a new locality for *A. fuscipennis* near Easton, Talbot County, in an infected orchard along the Miles River. The orchard contained a miscellaneous variety of fruits, and all the trees were quite seriously infested with the San Jose scale. Instructions had been given the owner to cut them down as soon as possible and burn them. A quantity of small branches incrusted with scale were brought to the laboratory and inclosed in breeding tubes. Much to my surprise these tubes were swarming with parasites a few days later From one tube 1,114 specimens of *Aphelinus fuscipennis* were taken; while a second tube gave 432, a third 1,478, and a fourth more than 1,000, but owing to an accident the count in the case last mentioned was not exact. The writer was greatly elated over the discovery, and immediately sent out the following statement to the State press:

I am advising my correspondents not to burn twigs and branches cut from trees infected with the San Jose scale. If the tree is so seriously infested it can not be saved, it should be dug up by the roots, trimmed, and the brush and wood piled in the orchard, where they should be left until about the 1st of June or longer. If the trees are to be sprayed with either a 25 per cent solution of kerosene and water, whale-oil soap (2 pounds in a gallon of water), or crude petroleum, the pruning should be done first and the cut branches gathered up and piled where the spray cannot reach them.

This is done to preserve the little friends nature has supplied to help keep the scale in check. If the twigs and branches are burned or sprayed the parasites would be destroyed, as they feed upon the scale insects and are now wintering under the shell-like cover protecting them. These parasites are very small, being scarcely visible to the naked eye, yet they play an important part in the economy of nature. They are wasp-like in general appearance and quite active. It would be very difficult to estimate the actual number of parasites present upon a 5 or 6 year old peach or plum tree, but it is safe to say that they would run into the millions if the parasitism was at same rate as upon the twigs in the tubes.

If I had burned these twigs I should have destroyed all the parasites. On the other hand, if I had left them on the ground in the orchard the little friends would have escaped and concentrated their attacks upon other trees where the scale had been missed by the sprays. It is clear, then, that by using a little judgment in these matters we can assist nature in restoring the balance she desires. Do not sit down and fold your arms thinking nature is going to restore this equilibrium at once; you must do your part faithfully and well. Prune your orchard as soon as possible and save every twig that contains a scale; then spray with a 25 per cent. solution of kerosene and water, using any first-class spray pump, or with whale-oil soap (2 pounds to a gallon of water), before the buds open.

There is no possibility of the scale spreading until some time after the 1st of June. The young begin to appear in the vicinity of Washington, D.C., June 10 to 15 [in 1900 young were seen by the writer crawling June 3 near Washington], and the insect continues to breed until very cold weather. We have seen young, just born, on trees as late as December 19. When a twig is cut off between, say, December 20 and May 15, there is no possible danger of the scale spreading from it. It is not possible to transfer one of these insects from one twig to another after it is "set" and formed a scale over its back, and all of them die as soon as the sap is dried out of a cut twig or branch. Badly infested trees of no commercial value should be cut down as soon as possible, before the buds open, and the brush piled. Do not leave the stump standing, as it may prove a veritable breeding place during the summer. If you are so unfortunate as to have this scale, remember that eternal vigilance must be the order of the day, and you will find before you are through with it that it is no trifling matter.

The orchard in question was not destroyed by burning, as first suggested, but the trees were pruned and the cuttings saved. In May, 1900, the writer had a large quantity of the branches from this orchard carefully packed and sent to Mr. W. W. Obbey, Grayson, Charles County; to Capt. R. S. Emory, Chestertown, Kent County, and to Hon. Charles G. Biggs, Sharpsburg, Washington County. Instructions were sent to place the infested branches in grape baskets and hang them about the orchard where the scale was most abundant In this manner we will establish *Aphelinus fuscipennis* in the various counties and under different conditions. We have every reason to believe that the experiment will prove successful.

In this case the study of parasitism has given us a valuable suggestion for the treatment of scale infested orchards, namely, never burn a twig or tree cut late in the fall, winter, or early spring. A positive remedy one day may be wrong the next day, just as we are able to unravel nature's secrets and interpret them for own good.

Since the above was read the writer has tested a lot of twigs from the Charles County orchard and has bred numerous specimens of *A. fuscipennis*, thus proving that a parasite is thoroughly established there.

Mr. A. H. Kirkland read a paper on "the Brown-tail Moth in Massachusetts," in which he gave an account of the natural spread of this injurious insect throughout the State. The infested area in 1896 was only 29 square miles; in 1899 this had increased to 928 square miles.

The next paper was by Mr. C. P. Gillette, who gave a series of interesting notes on some of the most important insects of Colorado. Mr. Johnson followed with "Notes on insects of economic importance in Maryland during 1900," and Prof. Webster with an account of the "Insects of the year in Ohio." Foremost among these he placed the Hessian fly, regarding which he said: "In point of destruction the Hessian fly outranks every other insect, when considered in connection with the wheat crop of 1900. It is doubtful if there will be over 20 per cent of an average crop in Ohio; the remaining 80 per cent may be largely charged up to the ravages of this pest. As an average crop in Ohio amounts to, approximately, 40,000,000 bushels, the loss may be computed at 32,000,000 bushels, which at the ruling market price would mean a loss of $22,400,000, at least three-fourths of which, or $16,800,000 can be justly charged up to the ravages of the Hessian fly. More extended studies of this outbreak and some of the meteorological phenomena connected therewith are given in another paper. The unprecedented abundance of the pest this year may be attributed largely to the almost total lack of parasites, the retardation of the fall brood over the northern half of the State, and the extremely favorable weather during the autumn of 1899, which enabled all but the very latest deposited eggs to hatch and the larvæ develop to the "flaxseeds" and thereby defy the adverse influences of winter. In many localities the later sown wheat escaped fall attack and up to May 1, 1900, was uninjured, but the flies developing in the earlier sown fields seemed to have migrated *en masse* and settled down on those sown later, and the result is that in many cases the destruction is as complete in the one as in the other."

Mr. Woodworth gave a short account of the Entomological situation in the State of California, referring especially to Scale insects, the Codling moth, peach and grape insects. The last paper read was by Dr. Fletcher of Ottawa, who gave an account of the most noticeable insect attacks of the year in Canada, mentioning those affecting fruit trees, roots and vegetables, cereals, fodder-plants, and trees and shrubs.

Before the meeting closed, an interesting discussion took place on the matter of common names for insects, in which a number of the members took part. A committee was appointed to deal with the common names of such injurious insects as may be discovered in the future and to remove ungainly and inappropriate names.

The following officers were appointed for the ensuing year: President—C. P. Gillette, Fort Collins, Col.; First Vice-President—A. D. Hopkins, Morgantown, West Va; Second Vice-President—E. P. Felt, Albany, N. Y.; Secretary-Treasurer—A. L. Quaintance, Experiment, Ga.

The next meeting will be held at Denver, Col. on the 22nd and 23rd of August, 1901.

REGULATIONS RE SAN JOSE SCALE

Extract from The Canada Gazette of Saturday, January 12, 1901.

ORDER IN COUNCIL.

His Excellency, in virtue of the provisions of section 5, chapter 23, 61 Victoria, intituled "An Act to protect Canada from the Insect Pest known as the San Jose Scale," and of 63-64 Victoria, chap. 31, "An Act to amend the San Jose Scale Act," and by and with the advice of the Queen's Privy Council for Canada, is pleased to order that exemption from the operations of the above mentioned Act shall be and is hereby authorized of any trees, shrubs, plants, vines, grafts, cuttings or buds, commonly called Nursery Stock from any country or state to which "The San Jose Scale Act" applies; and that all importations thereof shall be and are hereby permitted to be entered at the Customs Ports only of St. John, N.B., St. John's, Que., Niagara Falls and Windsor, Ont., and Winnipeg, Manitoba, between the following dates in each year: 15th March to 15th May in the spring, and 7th October to 7th December, in the autumn; and at Vancouver, British Columbia, during the winter months only from 15th October to 15th March, at which ports they will be thoroughly fumigated with hydrocyanic acid gas by a competent Government official in accordance with the most approved methods.

All shipments made in accordance with the above will be entirely at the risk of the shippers or consignees, the Government assuming no risk whatever.

Packages must be addressed so as to enter Canada at one of the above named ports of entry, and the route by which they will be shipped must be clearly stated upon each package.

As it is well known that well matured and thoroughly dormant nursery stock may be safely treated, but that there is danger of serious injury to the trees if fumigated in the autumn before the buds are thoroughly dormant, or in the spring after the buds have begun to unfold, all stock which when received is immature or too far advanced for safe treatment will be refused entry and held at the risk of the shipper.

His Excellency, in virtue of the provisions of section 7 of the Act first above mentioned, is pleased to direct that the authority herein granted be published in the *Canada Gazette*.

JOHN J. McGEE,
Clerk of the Privy Council.

OTTAWA.

OBITUARY.

Mr. JOSEPH EVELEIGH TREFFRY died at Quebec, of spinal meningitis on the 27th day of April last—his second wife had died but a few months before. Mr. Treffry belonged to a Cornish family. He came to Canada about thirty years ago, and at first lived in Montreal. After a while he moved to Quebec, and for ten years was reporter and proof-reader on the staff of the *Morning Chronicle*. He left newspaper employment to accept the Government position of English translator in which he continued till his death. He had been a member of the Quebec Branch of the Entomological Society of Ontario from its formation; and his ready pen and ability as a journalist had often been exercised in its favour. Before his bereavement his wit and good humour had added greatly to the interest of the meetings of the branch. He was buried in Mount Hermon Cemetery.

T. W. F.

THE NORTH-WEST (CANADA) ENTOMOLOGICAL SOCIETY.

The second Annual Meeting of the North-West (Canada) Entomological Society was held at Lacombe, Alberta, on 16th January, 1901. It was a meeting essentially in the interests of farmers. At the request of the President, the chair was taken by Mr. F. H. Wolley-Dod, of Calgary, who was supported by the vice-President, Rev. M. White, and several well-known farmers of the district. A number of letters in support of the objects of the Society were read, including letters from Mr. C. W. Peterson, Deputy Commissioner of Agriculture, N.W.T.; Prof. C. C. James, Deputy Minister of Agriculture, Ontario; Dr. James Fletcher, Dominion Entomologist, and the Right Reverend the Bishop of Calgary and Saskatchewan.

The President of the Society, Percy B. Gregson, on being called upon (after the opening remarks by the Chairman) explained that the object of the Society was to instruct and interest the farmers of the North-West regarding the insects that affect them,—to bring home to them individually the principles which underlie the treatment of insect and weed pests, so that they can deal with them in time, without waiting, as so many do, till their crops are destroyed before applying for advice. Mr. Gregson stated that farmers were beginning to appreciate the value of the study of insects, and this was evidenced by the fact that a number of Agricultural Societies had during 1900 become active supporting members of the North-West Entomological Society. Mr. Gregson impressed on farmers the importance of careful observance of the habits of the insects that came under their notice, such as their time of appearance, their method of feeding, the nature of their food, etc. Some insects, such as beetles and caterpillars, feed by nibbling their food, and poison should therefore be placed on their food, so that the insects when consuming the leaf will also consume the poison with it. Other insects such as lice, pierce through the outside of the leaf with their trunk-like beaks, and poison, therefore will not reach them. As however, insects breathe through little openings in their sides they can be suffocated by anything which clogs up their breathing valves, such as coal oil emulsion, or the fumes of tobacco.

The list of injurious insects in the North-West is already a long one, and as insects always follow cultivation, we must, as the country gets cultivated, expect arrivals of fresh insects. There are very many ways by which insects are always liable to be imported into a new country. They may come in clothes, lumber, domestic animals, packing substances (such as hay, straw or grass). It was probably in packing substances that all the grass stem maggots, common to Europe and America, have reached us, including the Hessian fly, the wheat stem midge, and wheat stem saw-fly.

In applying remedies there is a reason for each different remedy recommended, and in the list of insects presently given the reason for each remedy can readily be seen.

The Principal Injurious Insects of the North west for 1900.

The Red Turnip-beetle (*Entomoscelis adonidis*). In many places from south of Calgary to north of Edmonton, and in Saskatchewan and several districts in Assiniboia this beetle has been more or less abundant—in some instances devastating entire fields. Around Beulah, in Manitoba, it has also been somewhat abundant, but chiefly confined to mustards. Remedy: Spray the plants with Paris Green solution (1 lb. to 160 gallons of water) and stir in also 1 lb. of quick-lime, or if in small quantity, ½ oz. of Paris Green, ½ oz. of quicklime, and a pail-full of water. In mixing Paris Green Dr. Fletcher recommends that it should first be made into a paste with a small quantity of warm water, and the paste afterwards mixed with the larger amount of water required. If it does not adhere readily to the leaf, a little soap added to the water will overcome the difficulty.

The Turnip flea Beetle (*Phyllotreta vittata*) has been very general throughout the North-west Territories, but the damage done was not great, owing to a counter-attraction in the shape of mustards. Remedy: Dust the young turnips with dry Paris Green and land plaster, or dry Paris Green and sifted ashes when the dew is on the young turnips. This little beetle hatches in May—about the third week—and by deferring sowing the turnips until June the beetle will have hatched and disappeared to native cruciferous plants before the young turnips are up.

The Diamond Back Moth (*Plutella cruciferarum*) in June and early July was extremely abundant throughout the Territories and in many parts of Manitoba, practically the whole of the cultivated area of Alberta, Assiniboia and Saskatchewan was visited by this pest, and many fields of cabbages, cauliflowers and turnips were completely destroyed. The larvæ of this moth also attacked lettuces. radishes, rape, etc. A field of turnips badly infested with this pest presents a weird and ghastly appearance. The riddled leaves are bleached and white like skeletons. Parasites have destroyed immense numbers of the larvæ. Remedy, as to turnips, young cabbages, etc., except lettuces: Paris Green solution as recommended for the Red Turnip-beetle. The chief difficulty is in getting at the underside of the leaf, as the larvæ principally attack from underneath, In the case of lettuces, hellebore should be used. Scatter on the leaves—as much underneath as possible—when the dew is on, a mixture of 1 lb. of hellebore to 2 lbs. of sifted ashes.

The Colorado Beetle (or Potato-bug) has again made its appearance in Central Alberta, though not in large numbers. On 28th June both larvæ and mature insects were seen in several potato fields, but no great damage done. As this is the second year of appearance of this insect in Alberta it is possible these are an advance guard, and it is well to look out for them. Remedy, the same as for the Red Turnip-beetle. Do not kill the lady-birds. This bright scarlet little beetle and its larvæ greedily devour the young larvæ of the Colorado beetle.

The Three-lined potato-beetle has been more troublesome than the Colorado beetle. In some localities in the south of Central Alberta it has seriously damaged potato crops, but its presence elsewhere has not been reported. This beetle was the chief insect pest of potatoes in Ontario until the arrival of the Colorado beetle, which it seems to have heralded. Remedy, the same as for the Red Turnip-beetle.

The Rocky Mountain Locust has been very bad in parts of Manitoba, north of Douglas, and around Aweme. This pest is dealt with in the May, June and July numbers of the leading agricultural journals, issued from Winnipeg, so fully and clearly that its characteristics and remedies need not be repeated at length. In the Nor'-West Farmer, for instance, of 21st May, 1900, is a very good account of them. The insect lays its eggs in the soil among the stubble in the early fall (August and September) and they hatch in the following spring. If, therefore, the soil be deeply fall plowed the eggs will be buried so deep that the young when they hatch cannot get to the surface.

Cutworms,—(in Alberta and Assiniboia principally the garden ones such as *Agrotis clandestina*, *Plusia brassicæ*, and *Carneades ochrogaster*) have caused the usual amount of loss and replanting in several districts among cabbage and cauliflower growers. It is difficult to understand why there need be any loss from this pest when the remedy is so easy. Remedy: Take say 50 lbs. of bran and very slightly moisten it with water, and sweeten with a little sugar. Then mix well with it enough Paris Green to just color the bran (e.-g. about a lb. of Paris green). The cutworms will eat this bran in preference to the cabbages. The common cutworm is not a climber, so wrapping a piece of smooth paper about 3 inches in breadth around the stem of the young cabbage when planting out is a good preventive remedy. The paper should be $\frac{1}{2}$ an inch below the surface of the soil and $2\frac{1}{2}$ inches above. Keep the garden clear of weeds and rubbish, old cabbages or cabbage stalks in the fall, so that the cutworm moth will have no attraction for laying its eggs. A more serious trouble, however, has been caused by another kind of cutworm in Manitoba. This is the glassy cutworm (*Hadena devastatrix*), and it, in the spring, committed very serious injury to wheat crops north of Stonewall. This pest was present in some fields in thousands, and marched in a phalanx devouring as they travelled. The remedy for the glassy cutworm is not easy. The grub burrows into the earth in the daytime, and comes to the surface to feed at night. It eats the whole plant, beginning just below the surface. Thoroughly spraying the grain along the front of their attack for a space of ten feet with a solution of Paris Green has been found successful. If however the crop has been ruined, turn chickens or turkeys into the field for a day or two, and then sowing oats for green feed might be tried.

Wireworms. These are the larvæ of the "click beetles." This is a pest very difficult to get at. There are several species of wireworm. They pass the winter in cells in the soil, so that for some species a plowing in August, and for others a plowing late in

the fall, will disturb these cells and kill the inmates by exposure. Seeding down only encourages the wireworm, but barley and rye seem distasteful to this pest, and fair crops of these can be grown even if the field be badly infested with it; and possibly the field itself be ultimately cleared of the pest.

Among pests of foliage has been the pallid aspen beetle. The loathsome larvæ of this beetle were very destructive to the early leaves of aspen poplars throughout Alberta and the Territories, and considerably marred their beauty. Remedy: Poison their food by spraying with Paris Green solution.

The striped cottonwood beetle was also very abundant on willows. The fetid larvæ emit, when disturbed, a milk like fluid from tubercles along their back, and trail a sticky fluid wherever they crawl upon the leaf. This is a very troublesome pest in the East, in districts where osiers are cultivated. The larvæ as well as the beetle cause the osier canes to branch by injuring the tips. Should osiers be cultivated in the Northwest this pest will be on hand. Remedy: Paris green or green arsenite solution sprayed on the food.

Lice on poplars and plants have been common in many parts of Alberta. *Remedy:* Suffocation by coal oil emulsion, or fumes of tobacco. The Western Blister Beetle was reported like "swarms of bees" on beans at Lethbridge in Southern Alberta about 25th June. Other blister beetles were abundant on vetches in Central and Northern Alberta.

Fleas. Towards the end of summer this pest became an intolerable nuisance throughout the Northwest. Hay mattresses swarmed with them. A slight odor of carbolic acid will prevent them from coming into a room so scented; but if introduced with hay or otherwise, then burning pyrethrum powder is a good remedy for driving them out.

Warbles in cattle appear to be on the increase. Cattle farmers are very well acquainted with this fly, but it is a trouble that is too apt to be treated as of not a very serious nature, and as not preventable. This, however, is a great mistake. In the first place the bot maggot, or warble, so damages the hides that grubby hides sell for one-third less than sound ones. But the beef itself is rendered so inferior that buyers of the highest class of meat, who supply hotels, &c., will not on any account buy carcasses showing traces of warble attack. Such beef has therefore to be sold at a lessened price below that obtainable for good beef, the reduction sometimes amounting to $5 per carcass. In view of the large and increasing exports of beef (cold stored) to England, it becomes important to see that the reputation of the Northwest is sustained by keeping stock free from this pest. In dairies, too, the loss sustained through the attacks of warbles is just as serious. There is the loss in quantity of flow of milk as well as deterioration in quality, resulting from the annoyance of the animals by the flies when depositing their eggs, and later by the grubs The shrinkage in the milk is estimated at 10 per cent. and the deterioration in quality at the same rate, making a total of 20 per cent. By the time the warbles are discovered in the spring the mischief is done. Certain localities are more particularly infested than others, and a dry season seems more encouraging to the warble fly than a wet season, and where there is danger of the warble the animals should be protected during the summer months by spraying them occasionally with strong smelling oils, such as fish oil, train oil, kerosene emulsion, &c.

To make kerosene or coal oil emulsion add to 1 gal. of kerosene hot soap suds made of $\frac{1}{2}$ gal. of water (rain water preferred) and $\frac{1}{4}$ lb. soap. Then churn all thoroughly together till it will adhere to the surface of glass without oiliness. When required for use, dilute the emulsion by adding from 9 to 15 times its measure of warm water.

After the close of the discussion consequent on the President's address, the officers of the Society for the year 1901 were elected. The officers for 1900 were re-elected in the capacities respectively held by them with the exception of A. D. Gregson, who retired from the curatorship, the same being accepted by Percy B. Gregson, the collections having been safely removed to his house.

Mr. F. H. Wolley-Dod most generously presented to the Society a large number of Lepidoptera, the bulk of which were new to the collection.

Mr. O. C. Poling, of Quincy, also presented to the Society several exceedingly rare specimens including Neophasia Terlootii and Erebia Magdalena. Some of these specimens are represented in but one or two other collections in the world.

After a vote of thanks to the Chairman, the proceedings terminated.

Report of the Council.

On behalf of the Council of the North West (Canada) Entomological Society, the President begs respectfully to submit the following report:

Several fresh works have been added to the library of the Society during 1900, among them being a complete set of "Insect Life," (partly the gift of Dr. L. O. Howard and partly by purchase). The impossibility in this distant country of access to an outside Library of any kind has been and is an obstacle which the Society hopes gradually to surmount by accumulating serviceable works of its own.

It is encouraging to note that the farmers are taking a marked and growing interest in economic entomology,—the President having during the past year given by request addresses or papers on twelve occasions and at various places in Alberta and Saskatchewan. Various agricultural societies have become active supporting members of the North-West Entomological Society.

A field class of young folk has been started in Lacombe, and operations (all being well) will be commenced in the ensuing spring.

A most welcome assistance has been received from the Territorial Government in the form of an annual grant of $25 towards furthering the objects of the society.

Acting on the advice of the original supporters of the Society, it was decided to defer attempting the issue of a magazine for a year, and in the meantime the president has, without cost to the society, circulated a large number of agricultural papers among farmers whenever such papers published matters of interest in economic entomology.

Percy B. Gregson,

1st January, 1901. *President.*

Auditors' Report.

Receipts and expenditure of the North-west (Canada) Entomological Society:

Receipts.		*Expenditure.*	
Members' Fees	$26 00	Library	$26 00
Territorial Government Grant	25 00	Stationery	7 00
Deficit (met by President)	38 50	Meetings (Farmers' etc.)	23 00
		Printing account	6 50
		Cork, pins, etc.	5 00
		Store books, glass, etc. and other apparatus	8 00
		Expense account (postage, etc)	7 00
		Subscriptions to periodicals	7 00
	$89 50		$89 50

I hereby certify that I have examined the books and vouchers of the Treasurer of the North-West (Canada) Entomological Society and find them correct, and the above is a true statement of the accounts of the Society.

J. L. Tipping,

Waghorn, 1st. January, 1901. *Auditor.*

INDEX.