

NINETEENTH ANNUAL REPORT
OF THE
ENTOMOLOGICAL SOCIETY
OF
ONTARIO,
1888.

Printed by Order of the Legislative Assembly.



TORONTO:
PRINTED BY WARWICK AND SONS, 68 AND 70 FRONT STREET WEST.
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To the Honourable t

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NINETEENTH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO.

To the Honourable the Minister of Agriculture :

SIR,—I have the honour to submit for your approval the annual report of the Entomological Society of Ontario for 1888.

Included in the report is the financial statement of the Society, and the transactions of the annual meeting held in Ottawa, at which the Society had the pleasure of your presence, thereby evincing an interest in matters Entomological which was much appreciated by the members of the Society, and which will, it is hoped, be a means of encouraging the work of Entomologists in our Province.

Our monthly journal, the *Canadian Entomologist*, has been regularly issued during the year, and some measure of the value in which it is held by students of agriculture may be obtained by the fact that many of the Agricultural Experiment Stations in the United States have purchased from the Society complete sets of the magazine for reference in the course of their work.

During the year the Society's collection of insects was returned from the Colonial Exhibition in London, England, and work is now in progress fitting it up as a permanent and representative collection for reference on the Entomology of Ontario.

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

W. E. SAUNDERS,
Secretary-Treasurer.

ANNUAL MEETING OF THE SOCIETY.

The annual meeting of the Society was held in the City Hall, Ottawa, on Friday and Saturday, October 5th and 6th, 1888. A Council meeting was held on Friday morning at 10.30 o'clock, in a committee room of the City Hall, at which the following members were present:—The President, Mr. James Fletcher, Ottawa; Mr. E. Baynes Reed, Mr. W. E. Saunders and Mr. J. M. Denton, London; Rev. C. J. S. Bethune, Port Hope; Rev. T. W. Fyles, Quebec; Mr. James Moffatt, Hamilton; Mr. H. H. Lyman, Montreal. After the transaction of routine business, the sum of \$200 was voted to the Library Fund for the purchase of books and the binding of periodicals and pamphlets. An Executive Committee, to consist of the President, the Editor, the Secretary-Treasurer and the members of the Council resident in London, was appointed to deal with all the financial affairs of the Society, and to provide for the representation of the Society at the annual meeting of the American Association for the Advancement of Science. The work of rearranging the Society's collections and putting them in good order was directed to be continued, and Mr. Moffatt was requested to do for the Coleoptera what he has already so successfully accomplished with the Lepidoptera.

In the afternoon the Society met at 2 o'clock. Mr. W. H. Harrington was present in addition to those above mentioned. Mr. Lyman exhibited a series of specimens of the different species of *Callimorpha* which he had described in his paper last year (*C. E.* xix. p. 181) and remarked upon their various peculiarities. He thought it most desirable that names should be attached to the different varieties, even though they may hereafter be found to belong to the same species. Messrs. Fletcher, Fyles and Moffatt made remarks upon the subject, and agreed that all distinct forms should have separate names.

Mr. Fletcher gave an account of his visit to Nepigon, Lake Superior, early in July, in company with Mr. S. H. Scudder, of Cambridge, Mass., for the purpose of collecting the eggs of various rare species of butterflies. He described the various modes he employed in order to induce the females to deposit their eggs and recounted the great success he had achieved in securing the eggs of no less than nine species of butterflies and capturing a large number of others.

Rev. Dr. Bethune exhibited a number of specimens of *Colias eurytheme*, chiefly of the form *eriphyle*, which he had taken at Port Arthur on the 1st of September, last, and gave an account of his trip to the Nepigon river, exhibiting a large number of specimens of butterflies and other insects captured there on August 21st, 22nd and 30th. Among these may be especially mentioned *Colias interior* and *eurytheme*, *Argynnis electa* and *bellona*, *Phyciodes tharos* and *nycteis*, *Grapta proque*, *Pyrameis huntera* and *cardui*, *Limenitis arthemis*, etc.

Rev. T. W. Fyles read a paper on *Chionobas jutta*, in which he recounted his success in rearing the insect through all its stages.

Mr. Fletcher and Dr. Bethune spoke of the desirability of issuing a series of papers on "Popular and Economic Entomology" in the *Canadian Entomologist*, and urged upon the members present the necessity of co-operating in the work. The editor also drew the attention of the meeting to the duty of at once providing the material required for the Annual Report of the Society.

The President laid on the table specimen sheets and plates of Mr. Scudder's great work on the butterflies of the Eastern States and Canada, which were examined by the members with much interest. He also brought up for discussion the subject of the disease known as "silver-top" in hay, which is believed to be caused by a species of Thrips, and requested the members to investigate the matter in their various localities. The only remedy at present suggested is the plowing up of the old hayfields which are found to be the most seriously attacked. The depredations of grasshoppers during the past season were next considered. Mr. Fletcher suggested that much might be done to reduce their numbers by cutting the hay about the 20th June, if practicable, and thus prevent-

ing the maturity of the fly to a distance for it. the Township of Delaware if measures were not t

In the evening the Hall at 8 o'clock, at which Drury, the recently Deputy Minister of Director of the Experiment. Whyte, President Mrs. Davidson and a President, Mr. James

THE LADIES AND GENTLEMEN
Council of the Entomological Society. The time has been given of the study of entomology within the last few years part of a few naturalists of insects which were first of discovering remedies to know that foremost North American entomologist in the United States, a gotten in this connection persistent labour, to discover enable them to meet a remarkable fact that we have enjoyed the charm to this practical aspect even more marked, and stood out prominently Kirby and Spence, and Eleanor A. Ormerod, who are now known the world studies were at one time treatise, that in the last an imbecile, upon the insects. These ages of to-day not only do the value of these studies, but their means the revenue of protecting all agricultural attacks of noxious insects and employ their own investigations. In many Within the last year in course of instruction at t

ing the maturity of the insects by depriving them of their food before they were able to fly to a distance for it. Mr. Denton reported that the Chinch bug had been observed in the Township of Delaware, near London, and that it was likely to become very injurious if measures were not taken to counteract it. The meeting adjourned at 5.30 p.m.

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tawa, on Friday and on Friday morning following members Baynes Reed, Mr. thune, Port Hope; I. H. Lyman, Mon- was voted to the cala and pamphlets. the Secretary-Trea- ted to deal with all on of the Society at it of Science. The order was directed to what he has already

EVENING SESSION.

In the evening the Society held a public meeting in the Council Chamber of the City Hall at 8 o'clock, at which there were about sixty persons present, including the Hon. C. Drury, the recently appointed Minister of Agriculture for Ontario; Mr. John Lowe, Deputy Minister of Agriculture for the Dominion of Canada; Professor Saunders, Director of the Experimental Farms of the Dominion; Sir James Grant, M.D.; Mr. R. B. Whyte, President of the Ottawa Field Naturalist's Club; Mrs. Macleod Stewart, Mrs. Davidson and a number of farmers and gardeners from the city and neighbourhood.

The proceedings of the evening began with an able and practical address from the President, Mr. James Fletcher, of Ottawa, upon "Insects Injurious to Crops."

THE PRESIDENT'S ANNUAL ADDRESS.

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LADIES AND GENTLEMEN,—It is with feelings of undisguised pleasure that the Council of the Entomological Society of Ontario welcome you to this evening's meeting. The time has been when such a gathering would have been impossible. The appreciation of the study of entomology as a practical branch of economic science, has only sprung up within the last few years, and this too in response to great and incessant efforts on the part of a few naturalists to make their work useful, by specially studying those species of insects which were found to attack products of economic value, with the set purpose of discovering remedies to lessen or prevent the loss thereby sustained. It is gratifying to know that foremost amongst these practical men of science have been many of our North American entomologists. The names of Harris, Fitch, Walsh, Glover and Riley in the United States, and in Canada Saunders and Bethune, are names never to be forgotten in this connection for the work they have accomplished in the past, by patient, persistent labour, to distribute amongst cultivators intelligible knowledge which would enable them to meet and frustrate the attacks of their insect foes. It is a somewhat remarkable fact that until the last decade, comparatively few of the many students who have enjoyed the charms of the delightful study of entomology have turned their attention to this practical aspect of the case. In England, our dear mother-country, this want was even more marked, and until quite lately there were only two or three names which stood out prominently as having done conspicuous work in this line, such as Curtis, Kirby and Spence, and lastly, most important of all, our corresponding member, Miss Eleanor A. Ormerod, whose reports upon Injurious Insects and Methods of Prevention are now known the world over. Indeed, so great was the contempt in which these studies were at one time held that we are told by Kirby and Spence, in their classical treatise, that in the last century the will of a noble lady was actually set aside as that of an imbecile, upon the sole evidence that she had been known to collect and study insects. These ages of darkness and ignorance, however, have happily passed away, and to-day not only do the intelligent farmers, horticulturists and fruit-growers recognise the value of these studies, but every person of common sense appreciates the fact that by their means the revenue of every country may be largely increased, by giving methods of protecting all agricultural products from the large diminution attributable to the attacks of noxious insects. The Governments of many countries have recognised this, and employ their own State Entomologists, or appoint committees to carry on these investigations. In many American colleges they form part of the curriculum of studies. Within the last year in Ontario I am delighted to tell you they have been added to the course of instruction at the Ontario Agricultural College at Guelph. It is but natural that

those engaged in the cultivation of the soil should put the proper value upon the work of economic entomologists, for they year after year see a large amount of their produce destroyed under their very eyes by the ravages of injurious insects, thus rendering much of their labour of no effect, and their incomes proportionately smaller; they, too, have happily learnt by experience that much of this loss may be averted by following the advice of those specialists who devote their time to studying out the life-histories of their enemies.

Until recently there was what I will call a foolish fashion amongst scientific men to scoff and sneer at the labours of those few who endeavoured to develop the economic phase of Entomology. They did not believe, it was alleged, "in wasting time over popularising science. If scientific study was to be valuable it must be technical; there was not time to dish it up in a diluted and palatable form for the masses." As a matter of fact, however, we find that those who are continuously engaged in the practical economic application of Entomology to the daily wants of mankind, have done just as good work scientifically as any others; and to-day we see that these ultra-scientists find it advisable to keep their opinions to themselves, and day by day we find more and more of the best scientific students throwing in their lot with those who only aim at making their investigations useful and for the public good.

That the dangers arising from the increase in numbers of injurious insects are greater now than was formerly the case cannot, I think, be doubted.

In all new countries larger and larger areas of land are continually being brought under cultivation, and by growing large quantities of any one crop the farmer furnishes those insects which feed upon it with a copious supply of food, and their numbers increase correspondingly. A large supply of proper food is the main cause which affects the amount of insect presence. The food of insects varies considerably, and embraces almost all organic substances. Those which come under our consideration now are mainly vegetable feeders. Of these some will feed upon a great many different kinds of plants, belonging to various families or natural orders; others, and these, luckily for us, are by far the most numerous, will only eat a few, and these, too, must be plants of the same or an allied family. Others, again, are so particular that they will actually starve if they cannot obtain a certain species. In Nature we never find, as in our fields of grain or roots, any one plant filling a large space, to the total exclusion of all others; but they are scattered here and there, several kinds growing together, consequently the insects which feed upon any particular one of them have to search far and wide for their food. This limited food supply is one of the checks which keeps their numbers down to the proper limit. It has been estimated that every plant has an average of seven or eight different insects which feed upon it. This number is probably too low, and some of course are known to have many more than this. Dr. A. S. Packard states, in a little work of which I shall speak later on, that the oak affords maintenance to between 500 and 600 species of insects, the hickory to 140, the birch 100, the maple 85, the poplar 72, and the pine over 100. It may be safely stated that at least one-tenth of all the plants grown as crops by farmers is annually destroyed by insects. The amount of loss every year from this cause is so great, as shown by the instances where circumstances permit of an accurate computation being made, that it would be inadvisable for me to dwell upon the subject or to give many of the figures, for I fear you would not believe me. I will, however, give a few instances which can be verified by those who wish to do so.

In 1882 the lowest value which could be placed upon the agricultural produce destroyed by insects in the United States was \$200,000,000. In Canada in one year the wheat midge destroyed 8,000,000 bushels of wheat, and in 1884 the "clover-seed midge" destroyed \$650,000 worth of clover seed. In England in 1882 a single insect (the Hop Aphis), which belongs to one of the ten families which attack the hop, injured the crop to the extent of \$13,000,000.

Now, this enormous, and to a large measure unnecessary, waste can only be prevented by a systematic study of the life-histories of the insects which cause it. The habits or modes of life of insects are very various, and by no means always the same in the different stages. We have some species, as the Blister Beetles, which feed upon

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animal food as grubs, and entirely upon vegetables in their perfect state. Again, some, as the large Silkworm Moths, are very voracious as caterpillars, but when they reach the perfect state have the mouth parts undeveloped, and take no food. By finding out their habits in all the different stages we are enabled to attack them at their most vulnerable points. The one great object of the Entomological Society of Ontario is to gather together all possible information concerning injurious insects, and, whenever anything is discovered which it is thought may be useful to keep them in check, to publish it abroad and make it known as widely as possible. Nobly assisted by the Provincial Government we have now carried on our investigations for over twenty years. Through the medium of our annual reports to the Minister, which he includes in his report of the Agriculture and Arts Department, and also by means of the *Canadian Entomologist*, the monthly organ of the Society, a large amount of useful knowledge has been distributed amongst those most likely to benefit from it. I take pleasure in publicly making the announcement that the members of our Society wish it to be known that they hold whatever knowledge they have acquired entirely at the service of any one who may apply to them, and they will always be glad to answer questions and give advice concerning injurious and beneficial insects. Arrangements have been made during the present meeting to issue regularly in every number of the *Canadian Entomologist*, after 1st January next, at least one article upon economic or popular entomology. These will be prepared especially for those who are not entomologists, but who wish to learn something about the science; or for those who have not time nor perhaps inclination to take up entomology as a study, but who require simple and plainly-expressed information concerning the common pests which attack farm and garden crops.

Notwithstanding the large amount of injury annually due to the attacks of insects, and the enormous hosts of these creatures, the actual number of different kinds which must be classed as "first-class pests" is comparatively small. Of many of these the life-histories have already been worked out and remedies have been discovered, so that, with reference to most of the common crop insects, the farmer can now, for the trouble of asking for it, obtain advice which will enable him to stop or mitigate all the ordinary attacks to which his crops are liable. When a growing crop is observed to be attacked, the first thing to be done is to discover, if possible, the nature of the enemy. It is at this point that the value of knowing the life-histories of the common crop pests is made manifest, nay, is even indispensable, or much valuable time may be lost by the adoption of improper methods of prevention. It is sometimes possible to prevent serious loss by prompt action. This is particularly the case with those insects which are less active or more vulnerable during their preparatory stages than when they have reached their perfect form. A fact which is probably known to all of you present, but which cannot be too often repeated, is that the lives of all insects are divided up into four well marked periods or stages, during each of which their habits may be widely different. These stages are:

1. The egg, during which no injury can be done.
2. The caterpillar, during which stage, as a rule, the largest amount of the injury is perpetrated, as, indeed, the very name indicates. The word caterpillar means "food-pillager," a title, the application of which, I think, few will contest the propriety. (Fig. 1, a).
3. The chrysalis or pupa stage, in which, in most of the orders, the insect remains quiet and takes no food. (Fig. 1, b).
4. The perfect insect. (Fig. 1, c).

Some insects are injurious in all their stages after they leave the egg; but most of them only in the caterpillar form, or as caterpillar and perfect insect. Their habits, as I have said, vary greatly in the different orders, and there are, too, a great many orders, families, and species. Notwithstanding this, it will be found that the amount of knowledge necessary, for one who has not made a special study of entomology, to secure good results in combating their ravages, is neither extensive nor difficult to obtain. In apply-

ing remedies, the first thing to be considered is the nature of the attack, so that the most appropriate remedies may be made use of. It will be found, upon examination, that all injuries to vegetation by insects, conform to certain general plans in accordance with the



FIG. 1.

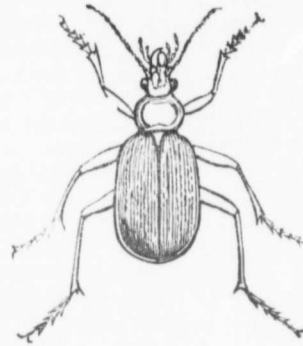


FIG. 2.

form of the mouth parts of the attacking insects, and therefore all remedies must be applied upon broad, general principles, dependent upon these structural characters. The



FIG. 3.

mouth parts of insects are all made upon one or other of two plans, they are either, 1, in the shape of jaws (Fig. 2), by which the substance of their food is masticated (Fig. 3); or 2. they form a hollow tube, by which the food is sucked up in a liquid condition. (Fig. 4). For insects of the first group, as a Colorado potato beetle, a caterpillar, or a grasshopper, all that is necessary is to apply to the foliage which it is desired to protect, some poisonous material which will not injure the plant, but which, being consumed with the leaves, will destroy the insects devouring them. Such a class of materials we have in various compounds containing arsenic. The best known of these is Paris green. For the second group, in which the insects do not masticate their food, such remedies would be useless, for the insects, having their mouth parts in the form of a long, slender beak or tube (Fig. 4), could pierce through these poisonous substances on the outside of their food, and extract the juices upon which they subsist from below the surface. Well known examples of this second group are the mosquito and the plant-lice, or *Aphides*. For these and similar insects it is necessary to make use of remedies which do not require to be eaten but which act by mere contact with their bodies, or by giving off some volatile noxious principle. For this purpose, preparations of coal oil or carbolic acid are useful, as well as the vegetable insecticide known as "insect powder," or pyrethrum. These remedies which I have mentioned are active remedies; but contrasted with these there is another class of equal importance, which are called preventive remedies, by which steps are taken to prevent anticipated attacks from taking place. Amongst these the most important are the following: High culture, by which a vigorous and healthy growth is promoted—a proper system of rotating crops, by which insects attracted to a locality by a certain crop will not have in that same locality two years running, the same plant to feed upon. Clean farming, by which all weeds and rubbish are prevented from accumulating. Changing the



FIG. 4.

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Of the insect passing notice, and and insatiable ene that is necessary i powder about the sills and about th not the same habit corners, it is neces the corners and r been found very u the foliage is used i jurious effects upon the best remedy fo pose it may be dil into the heads of insects may be di answerable for. amount of injury, these are the Colc borers, the oyster-

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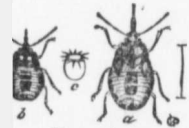


FIG. 4.

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time of planting, so that a crop liable to attack is presented to its enemies at the season of the year when they appear in such a condition that it cannot be injured. The planting of "traps" or small strips of a favourite food-plant to draw off the attack from desirable crops. The destroying or masking the natural odour of some vegetables, by scattering amongst them substances possessed of a stronger or disagreeable scent.

Of the insecticides mentioned above, one, viz., pyrethrum, deserves more than a passing notice, and its value for destroying house-flies and mosquitoes—those inveterate and insatiable enemies to mankind—should be known to everyone. For the former all that is necessary is to close the doors and windows, and puff a small quantity of the dry powder about the windows; in a short time the flies will be found lying on the window sills and about the room, paralyzed and dying. For mosquitoes, however, which have not the same habit as house-flies of flying frequently to the windows, but hide in dark corners, it is necessary to burn some of the powder, when the fumes will penetrate into all the corners and recesses, and perform the same useful office. This material, too, has been found very useful out of doors for destroying insects upon those vegetables of which the foliage is used as food. Although so deadly to insects it seems to have practically no injurious effects upon human beings, cattle, and the higher animals. It is, to my mind, by far the best remedy for the caterpillars of the imported white cabbage butterfly. For this purpose it may be diluted with four times its weight of common flour, and should be puffed into the heads of cabbages, when it will kill every caterpillar it touches. Injurious insects may be divided into three classes, according to the amount of injury they are answerable for. "First-class pests" are those which occur every year, and do a large amount of injury, unless they are kept in check by constant vigilance. Instances of these are the Colorado potato beetle, cut-worms, as a class, root maggots, the timber-borers, the oyster-shell bark-louse of the apple, the codling moth, and the plum curculio.

"Second-class pests" are those which occur every year, but not often in such large numbers as to cause wholesale destruction. Here, also, must be classed those which, although they may appear suddenly in sufficiently large numbers in restricted localities, to be classed as first-class pests in that locality, are not widespread, nor of general occurrence every year. Under the first division of this heading may be classed the army worm, as it occurs in most parts of Canada. The red-humped caterpillar of the apple, the fall web-worm, and wire-worms. Under the second division the pear-blight beetle (*X. dispar*), and the canker-worm, which have appeared for some years in parts of Nova Scotia as first-class pests, but which are seldom known in other parts of Canada as injurious insects.

"Third-class pests" are those which only occasionally attack cultivated vegetation in sufficient numbers to be injurious. Here I would class the large sphinx caterpillars of the grape, *Everys myron*, (Cram.) and *Philampelus achemon* (Drury), and the tomato worm, the clouded sulphur butterfly, and the common black and yellow swallow-tailed butterflies.

I will now refer briefly to some of the first-class pests which have given trouble during the past year in Ontario. The two attacks, concerning which most enquiries have been made, are cut-worms and grasshoppers. For the first of these, which have been remarkably abundant in all parts of Canada, from the Atlantic to the Pacific, several remedies have been tried; but it must be acknowledged that their attacks are extremely difficult to meet, and although some of the methods suggested have been enthusiastically commended by different experimenters, great caution must be exercised in giving the credit to any remedy so far known, as being an unfailing check upon their injuries. In seasons when they appear in only moderate numbers they are, of course, much more easily treated than when, as in the past summer, they suddenly develop in countless myriads, and remedies which are generally found satisfactory, then proved entirely inadequate. A circumstance which has sometimes been misleading to those not acquainted with the habits of these insects is, that their attacks are seldom complained of until the caterpillars have grown large, and are almost ready to turn to the chrysalis state. In several instances which have come under my notice this has been the case, and by the time the farmer had made up his mind to ask for assistance, had received advice, prepared and applied his remedy, it was time for the caterpillars to disappear underground and turn to chrysalids. The remedy, however, was applied, and the attack ceased, so the remedy suggested got

the credit of the whole benefit. Upon one or two occasions perfectly useless and inapplicable remedies for the attacks for which they were used, have been reported to me as quite successful, while, as a matter of fact, the caterpillars were full-fed, and were quietly undergoing their transformations beneath the soil. Cut-worms, for the most part, are the caterpillars of dull-coloured, active moths (Figs. 5 and 6), belonging to the three genera *Agrotis*, *Hadena*, and *Mamestra*, and comprise a large number of species. They may be described, in a general way, as smooth, almost naked, greasy looking caterpillars, of some dull shade of colour similar to the ground in which they hide during the day.

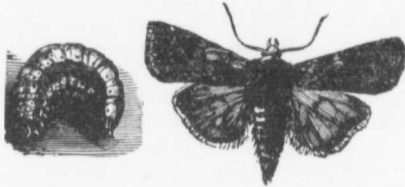


FIG. 5.

them are as follows: The egg is laid in the spring, summer or autumn, and the insects may pass the winter either in the perfect moth state, or as a caterpillar, or chrysalis. Those which hibernate as moths lay the spring eggs, and the moths are produced again before winter sets in. The eggs which are laid in the summer and autumn hatch soon after, and the caterpillars either become full-fed the same season and pass the winter underground in the chrysalis state, or after feeding for a short time become torpid, and pass the winter as half-grown caterpillars.

In this latter condition they may be found late in the autumn under stones and heaps of dead weeds, in the roots of grasses, or just beneath the surface of the ground. During the summer and autumn the attacks of these small caterpillars are seldom noticed on account of the abundance of vegetation. In the spring, however, this is far otherwise. The winter and the farmer together have removed from the fields all vegetation, except the crop which is to be grown, and when the caterpillars revived by the warmth of the sun and opening spring, come from their winter retreats there is nothing for them to eat but the farmers' early crops. They are particularly troublesome in gardens, cutting of young plants as soon as planted out. When full grown they enter the ground to the depth of a few inches and turn to chrysalids which eventually produce the dull-coloured, active night-flying moths above referred to. When disturbed they, like their caterpillars, have the habit of dropping to the ground and remaining perfectly still; from their sombre colour they are difficult to find. When at rest their wings lie horizontally over their backs and the upper ones entirely cover the lower pair (Fig 6). The upper wings

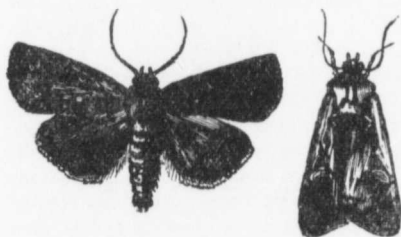


FIG. 6.

are generally crossed with more or less distinct bars and always bear two characteristic marks, one about half way down the wing orbicular in shape, the other nearer the tip reniform or kidney shaped. From their nocturnal habits it frequently happens that although cut-worms do a great amount of damage they are not recognized as the delinquents by some who have paid no attention to insects. They may be divided according to their habits into three classes. 1. Those which climb trees and destroy the buds. 2. Those which live on the surface of the ground and cut off herbaceous plants, just beneath the surface of the soil; and 3. Those which combine both of these habits. Of the first class, the climbing cut-worm *Agrotis scandens*, (Riley) is one of the commonest. This is sometimes very injurious to the young apple trees. It climbs up the trunk after dark and destroys the young fruit and leaf buds. Of the second class we cannot have a better example than the very troublesome "cabbage cut-worm," *Hadena devastatrix*, or *Agrotis Cochranii* (Fig. 5). Of the third

The head is smooth and shining, as also is a shield on the segment next to the head. Their habits are almost always nocturnal, lying hid by day just beneath the surface of the soil, they come out at night to feed. When disturbed they have a habit of curling up into a ring and lying motionless on their sides. (Fig. 5). Amongst the large number of species known as cut-worms, no doubt their habits vary somewhat; but probably those of most of

class may be more common in this May and devour and clover appear seem to change. It also at this time particularly part-ficult enemies to a vast number of s. After many experiments may be tried with myself found no sure preventive consideration, so occasion.

For climbing wide and roll it through the middle lower edge press cation of the surface of tomato cans of caterpillars being found useful for of trees which a an ounce to one pillars which attack.

The remedy application. The length of time, but have the greatest and destroying s and late ploughing effects of weather the latter is in spring, attacks with an obnoxious or sawdust saturated sprinkled round acts equally well destroyed in large attacked. These as grass, clover heavily or dip the rows in the with cut-worms, plant had been on either side.

very easily destroyed good effect by labor at work in the caterpillar will grow it may be destroyed.

The "army" but specimens obtained in from one locality however, were attacked by a pest

class may be mentioned the "black army worm," *Agrotis fennica*, a species which is much commoner in this district than was at one time supposed. The young caterpillars appear in May and devour many kinds of low herbs as strawberries and other garden plants; peas and clover appear to be preferred to everything else. About the end of May its habits seem to change and it feeds much more boldly, being frequently found feeding by day. It also at this time attacks young trees and bushes, devouring the buds and seems to be particularly partial to raspberry buds. There is no doubt that these cut-worms are very difficult enemies to combat. I have found them difficult to rear to maturity, and notwithstanding vast number of species the life histories of comparatively very few have been worked out. After many experiments and much observation some remedies have been devised which may be tried with a varying amount of success. I give some of those which I have myself found most beneficial. It must not be forgotten, however, that as yet we have no sure preventive of attack and I urge upon our members to give this matter their earnest consideration, so that we may be in a position to save more of the great loss they occasion.

For climbing cut-worms a sure remedy is to take a sheet of bright tin, six inches wide and roll it around the base of a tree so that the edges overlap and it forms a tube through the middle of which the tree passes. This may be kept in position by having the lower edge pressed into the ground and tying a piece of twine round the outside, a modification of the same device which may be used in gardens, is to cut out the top and bottom of tomato cans and place them over young cabbages, tomatoes, etc., the heavy-bodied caterpillars being unable to crawl up over the smooth surface. Another remedy I have found useful for climbing cut-worms, is to tie a strip of cotton-batting round the trunks of trees which also they are unable to crawl over. Spraying trees with Paris green, half an ounce to one pailful of water, will destroy these as well as many other kinds of caterpillars which attack young foliage.

The remedies for the second class or surface cut-worms are somewhat different of application. The caterpillars are essentially vagrants, not remaining in one place for any length of time, but wandering about at night from plant to plant. The remedies of which I have the greatest hope for this class are preventive, and consist of keeping down weeds and destroying all refuse in the autumn, so as to deprive them of food and winter shelter; and late ploughing by which the hibernating insects will be disturbed and exposed to the effects of weather and the attacks of insectivorous birds at a time when the food supply of the latter is limited. Poultry will be found valuable assistants in an orchard. In spring, attacks may be prevented by placing round the young plants some substance with an obnoxious odour. The most effective of these remedies I have found to be sand or sawdust saturated with carbolic acid or coal oil, a small quantity of which may be sprinkled round each plant or between the rows. Fresh gaslime used in the same way acts equally well. Another remedy suggested by Dr. Riley, by which they may be destroyed in large numbers, is by setting poisoned traps between the rows of the crop attacked. These are made as follows: Having procured a supply of some succulent plant as grass, clover, or even lamb's quarters, tie them in loose bundles and sprinkle them heavily or dip them in Paris green and water, then take them and place them between the rows in the fields. The lamb's quarters (*Chenopodium album*) is a favourite plant with cut-worms, and during the past season I noticed frequently where rows of this plant had been left standing between fields, that it was much more eaten than the crops on either side. As this weed springs up everywhere in cultivated ground and also is very easily destroyed, I cannot help thinking that this observation might be turned to good effect by leaving strips of it for a time to attract these insects. Where one has been at work in the night, it can be at once detected by the withered top of the plant, and the caterpillar will generally be found just beneath the surface of the ground at its root when it may be destroyed.

The "army worm" has been reported as injurious from several localities in Ontario; but specimens of the true army worm (*Leucania unipuncta*, Haw) have only been sent in from one locality, namely, from the new settlement at Lake Temiscaming. A few, however, were bred from caterpillars taken on wheat at Ottawa. Of these many were attacked by a parasite, which Prof. Riley has identified as a new species of *Apanteles*.

All the other consignments of these insects which were received proved to be the caterpillars of the clover cut-worm (*Mamestra trifolii*). They appeared in large numbers during the month of August and did considerable damage, particularly in fields of peas, turnips and mangold wurtzel. This insect seldom appears in Canada as a serious pest, nor from the condition of the consignments received by me do I anticipate that we shall suffer from their attacks again next year. Of five lots of caterpillars sent from different localities, nearly every specimen was found to be parasitised. One lot of over a dozen caterpillars only gave, instead of moths, specimens of *Ophion purgatum*, an active and beneficial Ichneumon fly, from the other larvæ were reared Tachina flies. A fact which has frequently been observed with regard to these caterpillars, and one which gives great comfort, is that whenever they increase largely in numbers they are invariably checked by the appearance of friendly parasitic insects. It must be remembered that all insects are not injurious, but on the other hand that many are very beneficial, preying upon and destroying injurious kinds. These belong to different natural orders. Amongst the Hymenoptera we find the Ichneumon flies. The female is, as a rule, provided with a long slender ovipositor, by means of which she inserts her eggs beneath the skin of her victim, or, as in the case of our largest species *Thalassa lunator*, which has an ovipositor between four and five inches in length, pushes it into the burrow of the woodboring host. The eggs of some are laid upon the outside of the skin and not inserted beneath it. These parasites are some of them as *Thalassa* external feeders lying alongside of their hosts, they pierce through their skins and suck out the juices, some, and probably most, as the grub of the Ophion above-mentioned, after hatching, lie inside the cavity of the body of the caterpillar, growing with it and feeding upon its blood, but avoiding all vital portions. When full-grown they either eat their way out and pupate in the ground or complete their changes inside the dead caterpillar. Of the Diptera or two-winged flies, there are several species of Tachina flies, which closely resemble our common house flies. These lay their eggs on the surface of the skin of the caterpillar, to which they adhere firmly. When the young maggot hatches, it eats its way through the skin into the body of its host and thrives at its expense. In addition to the above there is a class of parasitic fungi which attacks caterpillars when they appear in large numbers. One species *Entomophthora virescens*, Thaxter, has done good service in this district by keeping down the larvæ of *Agrotis fennica*. The work of this beneficial fungus was detected again this year.

The other attack which I have mentioned as having been of exceptional severity during the past season was that of various kinds of locusts. These are generally incorrectly spoken of as grasshoppers. Early in June the fields in the neighbourhood of Ottawa were found to be swarming with myriads of tiny locusts. Later in the season these developed and committed serious depredations upon almost every green plant of a few feet in height. Their numbers were so great that ordinary remedies were useless. In an effort to protect some special plants a mixture of bran, sugar and arsenic, as suggested by Prof. Riley, was used and certainly killed large numbers, but the dead bodies and every green thing near them were soon demolished by the survivors. Mechanical apparatus for catching and destroying them would have been the only way to deal with them after they attained the perfect form. If, however, the hay fields had been cut about a fortnight earlier, I believe enormous numbers would have been destroyed. Hay was cut about the first of July in this district, and just at that time the first perfect specimens of our commonest species *Melanoplus femur-rubrum* (fig. 7), and *M. atlantis* were observed. Had the hay been cut about the 20th



FIG. 7.

June, as it might have been without injury to the crop, the greater part of the first brood must have perished. In a crop like hay, which covers the ground thickly, there is very little active vegetation at the roots, but a great deal of moisture is kept from evaporating. As soon as the crop is cut all that is left on the fields above the surface is at once dried up by the action of the sun and air and the plant does not shoot up again for some weeks. In very wet seasons, of course, this takes place sooner. Last July, and the end of June were excessively hot and

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dry in this section, and what grass was left on the fields after the hay was cut could not possibly have supported the large numbers of locusts which afterwards devastated our crops. By waiting until 1st July they had reached the final stage in which they can fly, and were enabled to migrate from field to field, which they could not possibly have done in their earlier stages by hopping, for it must be remembered that their wings do not grow gradually until they reach their full size, but appear suddenly after the last moult. Locusts pass through seven stages—the egg, two larval stages, three pupal stages and the perfect insect. In the larval stages there is no appearance of wings; after the second moult, however, small wing pads appear; these increase gradually during the two succeeding moults, but when the pupal life is completed and just before it moults the last time and becomes perfect the wing pads are only about a quarter of an inch long. When the last moult takes place, however, and this only takes a few moments when the time comes, from these short wing pads are unfolded copious gauzy wings over an inch in length. In a few hours these harden and are ready to transport their bearers from place to place upon their mission of destruction.

An attack upon the hay crop, which is receiving the careful attention of the members of the society at the present time, is one known as "Silver-top." It has been noticed for some years that early in June the top joints of some of the flowering stems of June grass, also called "Kentucky Blue Grass," (*Poa pratensis*, L.) and later on in the month those of timothy (*Phleum pratense*, L.) turn white as though prematurely ripened. Upon examination these are found to have been injured above the top node. Many causes for this injury have been suggested, but as yet it is still undiscovered. The most prevalent idea is that it is the work of a kind of *Thrips*, but this is by no means proved. The lower part of the top joint has the appearance of having been sucked dry by some suctorial insect; the tissues of the stem apparently not being torn as in the case of the wheat-stem maggot (*Meromyza Americana*). The only observation so far made which appears to me to be of importance is that the attack is worst in old and exhausted meadows. This suggests breaking up such lands and manuring freely. The result of this treatment will be seen next year upon some fields where this has been tried. This attack is very similar in its effects to that of the wheat-stem maggot upon growing wheat, and like it, has steadily increased during the last three or four years. It is to be hoped, however, that as more information is gathered with regard to these attacks, practicable remedies will be discovered.

The many species of timber-boring beetles which attack our pine forests are receiving special attention from our members.

The apple worm, the caterpillar of the codling moth, (*Carpocapsa pomonella*), has been destructive in many localities; but by judiciously spraying the trees directly the petals of the flowers had fallen many fruit growers considerably lessened this evil.

The injuries to the clover-seed crop by the clover-seed midge are being also much reduced by the adoption of the system recommended in our reports of pasturing or cutting the first crop before the middle of June.

The Colorado potato beetle and the gooseberry sawfly are no longer to be feared, as easy and (when properly applied) perfectly harmless remedies have been discovered in Paris green for the one and hellebore for the other.

I must not delay you longer, but before I close I have to draw your attention to two works of exceptional interest, the first is one entitled "Entomology for Beginners," by Dr. A. S. Packard, of Providence, R. I. This is of great interest to us all, for notwithstanding, as I have endeavoured to show you this evening, the real and recognized importance of Entomological studies, we had not until this appeared any book of low price and convenient size which could be used as a class book in schools. This was a great want which is now filled by Dr. Packard's book. Another want of equal prominence was some good illustrated book which could be used as an introductory work for the use of beginners without their having to procure a number of reports and large volumes. Copious instructions are given for collecting, preserving and classifying insects, as well as references to the leading works on the different branches of the science. The section treating of classification is perhaps too much condensed, but will be found very

useful. An excellent chapter is given upon injurious and beneficial insects, enumerating some of what we should call the first class pests and giving the most approved remedies.

The other work to which I wish to draw your attention is Mr. Scudder's, "Butterflies of the Eastern United States and Canada." This magnificent work, of which I have here an advance copy of the first part to show you, is the result of twenty years' constant study by one of our best Entomologists upon a single subject. No work has ever appeared in any country upon a single branch of science where such thorough and complete information is given of the objects discussed, nor which has been so lavishly and accurately illustrated. The technical descriptions are very long and carefully worded, which gives them a special value. Descriptions of insects are sometimes too short, the object of the describers being only to give such facts as will lead to the infallible identification of the species. In Mr. Scudder's work the excellent illustrations will accomplish this end, and the descriptions have been made use of by the author for recording systematically in one place, every available item of knowledge, even to the most minute structural detail. These will be studied with avidity by all specialists. The work is to be lightened throughout by the introduction of a series of descriptive essays upon all the interesting problems which arise in the study of butterflies.

At the beginning of my address I drew your attention to the increasing popularity with which entomological studies were regarded at the present time, and in the name of the Society I thank you for your presence here this evening. We take it as no small compliment that the honourable Minister of Agriculture for Ontario should take the trouble to come all the way from Toronto on purpose to attend our meeting, and we beg to publicly thank him, and also Mr. John Lowe, the Deputy Minister of Agriculture for the Dominion, for this manifestation of their interest in our Society, which will doubtless be of much benefit to us.

Personally, ladies and gentlemen, I beg to thank you for the patience with which you have listened to me in laying before you a statement of the work we are now doing and hope to do in the future, and I trust your verdict will be that the Entomological Society of Ontario is doing good work of general utility to the country at large.

JAMES FLETCHER.

During the discussion which followed the address the President begged leave to add a few words with reference to a subject which he had inadvertently omitted. It was not upon insects, but was intimately connected with economic entomology. Referring to the introduction of the English sparrow he spoke as follows:—A subject demanding immediate attention at the hands of economic entomologists, as one of the influences which materially affect the amount of insect presence, is the great and rapid increase in the numbers of this bird. Introduced into Canada but a few years it has already increased in some places to such an extent as to be a troublesome pest, and steps should be at once taken to exterminate it. I am perfectly aware that some will oppose this view. Many from sentimental and so-called humane but mistaken motives, urge strongly the claims of these audacious little miscreants as useful insectivorous birds. After a careful investigation of the matter, however, I am fully satisfied that, although during the breeding season they do undoubtedly destroy many soft bodied insects as food for their young, this good office is by far outweighed by the harm they do in driving away truly insectivorous birds, and by their direct ravages upon grain crops. Now, this question is one of great importance and no matter of mere sentiment. If these birds are to any great extent insectivorous, it would be extremely rash for a society like ours, whose object is to preserve crops from the attacks of insects, to recklessly advocate the destruction of their natural enemies. I shall not dwell further upon this subject, as an elaborate paper has been prepared upon their habits by Mr. W. E. Saunders, who is well qualified for the task; but I believe their introduction into North America was a mistake which is deeply to be deplored.

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The Hon. Charles Drury next addressed the meeting. He said that he had not come to deliver a speech, but he had travelled five hundred miles in order that, as the head of the Agricultural Department of Ontario, he might show the importance which the Government he represented attached to the work of the Entomologists. He considered that the small grant annually made to the funds of the Society was amply repaid by its practical work, and mentioned as an instance the immense saving to the country effected by the President's discovery of the remedy for the clover-seed midge.

Sir James Grant spoke in graceful terms and delivered a very interesting address. He described the importance of entomology in its various aspects and referred to the work of some of its greatest masters, from Aristotle and Pliny, in ancient times, to LeConte, who had described so enormous a number of species of beetles, and whose lamented death was so great a loss to science. He described its relations to other departments, especially to medicine, and mentioned as an instance the fact that bacteria had been introduced into the blood by the bite of mosquitoes. He paid a high compliment to the President for his practical and interesting address, and for his enthusiastic devotion to the science, which had deservedly won for him the recognition of the Dominion Government.

Professor Saunders rose to move a vote of thanks to the President for his valuable address. He gave a short account of the history of the Society and its work, and mentioned the fact that there were only two of the original members present besides himself, viz., Dr. Bethune and Mr. E. Baynes Reed, who had been concerned in its organization twenty-five years ago. Sir James Grant seconded the vote of thanks, which was put to the meeting by Dr. Bethune and unanimously carried.

Rev. Dr. Bethune then proceeded to give a brief address, in which he strongly urged the importance of encouraging young people in their instinctive fondness for collecting insects. It was not only a most useful pursuit from an educational point of view, but led to great results in developing a love for science and a steady increase in the number of its votaries. As one of the pioneers of the society, he was delighted to see for the first time at one of its meetings the Provincial Minister of Agriculture, and also the Dominion Deputy Minister. He expressed his pleasure also at the presence of so many ladies, and trusted that they would bring to the aid of entomology all those gifts of deftness and neatness which they so eminently possessed. For their encouragement he mentioned that the most distinguished entomologist in England at the present time is a lady, Miss E. Ormerod, of St. Albans.

In acknowledging the vote of thanks Mr. Fletcher took occasion to refer to one point which he had overlooked, namely, the injuries inflicted by "that miscreant, the English sparrow," whose extermination he strongly advocated. The Hon. W. Drury stated that this destructive bird was no longer under the protection of the Act of Parliament respecting insectivorous birds, and that everyone was at liberty to aid in reducing its numbers.

The meeting then adjourned.

At 10 o'clock a.m. on Saturday, a meeting of the Council was held for the transaction of business, and after its adjournment the Society continued its proceedings.

The reports of the Secretary-Treasurer, the Librarian, the delegate to the Royal Society of Canada, the Montreal Branch, and the delegates to the Entomological Club of the American Association for the Advancement of Science, were presented and adopted.

The following gentlemen were elected officers for the ensuing year :

President—James Fletcher, F.R.S.C., F.L.S., Ottawa.

Vice-President—E. Baynes Reed, London.

Secretary-Treasurer—W. E. Saunders, London.

- Librarian—E. Baynes Reed, London.
 Curator—Henry S. Saunders, London.
 Council—J. M. Denton, London; James Moffat, Hamilton; Gamble Geddes, Toronto; W. H. Harrington, Ottawa; Rev. T. W. Fyles, M.A., South Quebec, (and the former Presidents who are *ex-officio* members, Prof. Saunders, F.R.S.C., F.L.S., F.C.S., and Rev. C. J. S. Bethune.)
 Editor of *The Canadian Entomologist*—Rev. C. J. S. Bethune, M.A., D.C.L., Port Hope.
 Editing Committee—The President, Prof. Saunders, J. M. Denton, H. H. Lyman, Dr. W. Brodie (Toronto).
 Auditors—J. M. Denton and E. B. Reed.
 Delegate to Royal Society of Canada—H. H. Lyman, Montreal.

REPORT OF THE COUNCIL.

The Council presented their report for 1887-8 as follows :

1. They have much pleasure in recording the continued progress of the Society ; the membership has been considerably increased during the year and the prospects are encouraging for still further accessions to the roll.
2. The Council have noticed with great satisfaction that the important Department of Agriculture has been placed under the charge of a separate Minister of the Government. They desire to avail themselves of this opportunity to tender their respectful congratulations to the Hon. Charles Drury, who has so recently accepted the important and responsible position of Minister of Agriculture for the Province of Ontario, and to assure him that the members of the Entomological Society recognize the value of his long and practical experience as an agriculturist.
3. The *Canadian Entomologist*, the organ of the Society, has been issued with promptness, and it has maintained to the full its well earned reputation as a scientific periodical. It is the intention of the Council to endeavour to make its value and usefulness still more marked, and to publish papers on economic and popular entomology, more especially adapted to interest beginners in the study of this branch of natural history. The chief object of the Entomological Society is to familiarize the fruit-grower and the agriculturist with the many and varied forms of insect life, and while teaching them to distinguish between friends and foes to endeavour to discover and apply practical remedies for insect depredations.
4. During the past season the attention of the Society has been called to what is known as "Silver-top" in the hay crop, which, in some districts has seriously affected the value of the yield. It is believed to be the work of a "Thrips." Acting under the suggestion of the Society, experiments have been tried in ploughing up the old pasture lands where the pest seemed most injurious, and it is hoped that this treatment may be found beneficial. Close attention will be given to this matter during next season.
5. The Council desire to be informed of any insect attacks on the various crops, and they invite, as heretofore, correspondence on these matters, and will gladly hold themselves in readiness to give any practical information and assistance that may be in their power.
6. The Library has been added to during the year and now forms a very valuable collection of natural history works of reference.
7. The fine collections of the Society have received the attention of the Council during the year. The Lepidoptera have been carefully revised and rearranged in the most suitable manner, so as to afford opportunity for comparison. It is intended, as soon as possible, to treat the collection of Coleoptera in the same manner.
8. In accordance with the custom of the Society, a deputation was sent to attend the meeting of the Entomological Club of the American Association for the Advancement of Science. The President (Mr. Jas. Fletcher) and the Editor (Rev. Dr. Bethune) attended the session at Cleveland, Ohio. Mr. Fletcher had the honour of being elected

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President of the Club for the ensuing year. Aided chiefly by the efforts of the delegation, the City of Toronto was chosen as the place of the next meeting, in 1889, of the Association. The Council invite the cordial co-operation of the members of the Society in making the meeting a successful one, especially to the Entomological and Botanical Clubs.

9. The report of the delegate to the Royal Society is presented herewith.
10. The accounts have been duly audited, and will be submitted as usual.

Respectfully submitted on behalf of the Council.

W. E. SAUNDERS,
Secretary-Treasurer.

ANNUAL STATEMENT OF THE SECRETARY-TREASURER.

Receipts, 1887-8.

Balance from previous year.....	\$85 59
Subscriptions	583 61
Sales of <i>Entomologist</i> , pins, cork, and advertising.....	324 19
Government grant.....	1,000 00
Interest.....	8 76
	\$2,002 15

Expenditure, 1887-8.

Printing	\$601 66
Expenses of report and meetings	411 08
Library	331 38
Refitting collections.....	71 00
Expense and merchandise	175 66
Grants to officers	225 00
Rent	40 00
Insurance	23 91
Balance in hand	122 46
	\$2,002 15

We certify that we have examined the above statement with books and vouchers, and found the same to be correct.

F. B. REED, }
J. M. DENTON, } Auditors.

REPORT OF THE LIBRARIAN.

I beg leave to submit my Report as Librarian of the Entomological Society for the year ending September 30th, 1888:—

The total number of books now on the catalogue is 987, and there are a number of volumes waiting to be bound.

During the year some valuable additions have been made to the Library by purchase and exchange, and the departments of Zoology and Botany have been increased.

Among those of special interest are :—

- Rolleston's* Forms of Animal Life.
Claus & Sedgwick's Text-Book of Zoology.
Jordan's Manual of the Vertebrates.
Merrian's Mammals of the Adirondacks.
Ridgway's Waterbirds of North America.
 " Manual of N.A. Birds.
The A.O.U. Code and Check-List of N.A. Birds.
Coues's Key to N.A. Birds.
Capen's Oology of New England.
Sachs's Lectures on the Physiology of Plants.
De Bary's Lectures on Bacteria.
 " Comparative Morphology of Fungi, Mycetoza and Bacteria.
Bower & Vine's Practical Botany.
Henston's Origin of Floral Structures.
Wood's Class-Book of Botany.
Bessey's Botany.
Culpepper's Complete Herbal.

The books are in good order and well protected, and due record is kept of all books borrowed.

It will be necessary that additional cases should shortly be provided.

The *Canadian Entomologist* has been regularly issued and mailed, and the back volumes and numbers are carefully stored and made easily available when required.

The electrotypes and wood cuts are in due order, and it is suggested that sheets be prepared for use of those requiring them, shewing the various orders properly classified and arranged.

I would submit for the consideration of the members the great desirability, in the interests of the Society, that an effort should, if possible, be made to have the rooms open at stated times for free reference and inspection by the public.

The cabinets have been thoroughly gone over, and the Lepidoptera rearranged, since their return from England, and printed lists of Lepidoptera have been prepared and distributed to members, shewing the desiderata required to fill up and complete the collection.

Respectfully submitted.

E. BAYNES REED,
 Librarian.

REPORT TO THE ROYAL SOCIETY OF CANADA.

As delegate from the Entomological Society of Ontario, I have much pleasure in submitting a concise report of its work and progress during the past year.

The Society, although nominally an Ontario institution, and largely supported by a liberal annual grant from that Province, is composed of members scattered all over the Dominion, besides having associate members throughout the United States, as well as scattered all over the world.

For the past fifteen years a branch has been maintained in Montreal, and though we have there suffered a severe blow during the past year in the death of our esteemed President, Mr. G. J. Bowles, an enthusiastic entomologist, and for several years a member of the Editorial Committee of the *Canadian Entomologist*, I have great hopes of our being able to keep the branch in active operation.

The monthly issued during the devoted exclusively nineteenth volume reading matter, w standard of forme sixty-two new spe to thirty-seven in entomologists of tl

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The fifteenth s of Ontario was held ensuing year :—Pr Treasurer, E. C. Tr The reports of Mr. Lyman sh Bethune at Credit Mr. Winn she Canada.

The monthly journal of the Society, the *Canadian Entomologist*, has been regularly issued during the past year, and still continues to hold its place as the leading magazine devoted exclusively to entomology published on this continent. It has completed its nineteenth volume and entered upon its twentieth. The former consists of 240 pages of reading matter, with one plate besides the index. The subject matter is fully up to the standard of former volumes, both in interest and importance. Three new genera and sixty-two new species were described in it, and the contributors to its pages, amounting to thirty-seven in number, embrace a considerable portion of the active and eminent entomologists of this continent, as well as others of less note.

For a number of years past one of the most important and valuable features of the *Entomologist* has been the very full descriptions of the preparatory stages or life histories of a considerable number of butterflies and some beetles, which have been contributed by entomologists eminent in their respective branches. These descriptions have been accumulating from year to year, and now amount to a very large number in comparison with the number of those whose early stages were known fifteen or twenty years ago.

The annual report of the Society for the year 1887 has been somewhat delayed, not having yet been issued to the members, but it is expected to be distributed within a few days and will no doubt be quite up to the high standard of the reports of previous years.

The very important collection of insects exhibited by the Society at the Colonial and Indian Exhibition was duly returned to the Society's headquarters at London, Ont. Upon examination it was found that some of the specimens had been badly damaged on the journey, as was naturally to be expected, and that many others had suffered very much from the long continued exposure to the light at the exhibition, as must inevitably occur under similar circumstances. The Society has accordingly issued a list of species required to place its collection again in perfect order, and, though the list is large, many have already been received, and it is to be hoped that the remainder of the specimens needed may be forthcoming from the members at no distant day.

The establishment in connection with the Department of Agriculture of the Central Experimental Farm, under the able direction of Mr. William Saunders, a former president of the Entomological Society, and the appointment to the position of Entomologist in connection with the same of so able and active an entomologist as Mr. James Fletcher, the present President of the Society, is likely to prove of vast importance to the country. The active work which is now being carried on will certainly prove of great benefit to the agriculturists of this country, not only by showing what crops it will be best to grow, but also how to preserve those crops from the destructive ravages of their tiny insect foes.

H. H. LYMAN,

WES REED,
Librarian.

ANNUAL MEETING OF THE MONTREAL BRANCH.

The fifteenth annual meeting of the Montreal Branch of the Entomological Society of Ontario was held on May 8, 1888, when the following officers were elected for the ensuing year:—President, H. H. Lyman; Vice-President, F. B. Caulfield; Secretary-Treasurer, E. C. Trenholme; Council, J. F. Haussen, A. F. Winn.

The reports of the Council and Secretary-Treasurer were read and on motion adopted.

Mr. Lyman shewed some curious varieties of *Callimorpha confusa* taken by Mr. Bethune at Credit and Port Hope, Ontario.

Mr. Winn shewed some interesting Geometers taken at Montreal and other parts of Canada.

FIFTEENTH ANNUAL REPORT OF THE MONTREAL BRANCH OF THE
ENTOMOLOGICAL SOCIETY OF ONTARIO.

The Council beg to submit the following report for the year 1887-1888 :

It is with profound regret that your Council have to record the death, early in the past year, of our most highly esteemed President, Mr. George J. Bowles, after a prolonged illness.

Mr. Bowles's enthusiasm for entomology and his untiring exertions to promote the welfare and success of the Branch, as well as his many amiable personal qualities are well known, and his premature death threatened the very existence of our Society in this city.

Your Council, however, determined to make every effort to keep the Branch in existence, and have great hopes of being able to do so in spite of the great loss which has been sustained.

On account of the President's illness no meeting was held after the annual meeting until July 20, when a special meeting was convened to pass resolutions upon his death. After that sad event no attempt was made to hold any meetings until the winter had well set in, since which three meetings have been held at which the following papers have been read :—

1. Notes on the Genus *Colias*.—H. H. Lyman, published in *Canadian Entomologist*.
2. Canadian Diptera.—F. B. Caulfield.
3. List of Orthoptera, taken in the Canadian North-west by Mr. James Fletcher.—F. B. Caulfield.

During the year one member of the Society, Mr. W. H. Smith, has resigned, and one new member, Mr. A. F. Winn, has been elected.

The collection left by Mr. Bowles was purchased by a friend of McGill University and donated to that institution, forming a most valuable addition to its magnificent museum.

In conclusion, your Council would strongly urge all the members to renewed activity in this our favorite science in which so much remains undiscovered and awaiting investigation. The death of our late President instead of discouraging us should beget greater zeal and a determination to keep up the Branch in which he took such great interest. The whole is respectfully submitted.

H. H. LYMAN,
Vice-President.

Papers were read by (1) the Rev. T. W. Fyles on "The Hypenidæ of the Province of Quebec;" (2) Mr. J. Moffatt on "Some Curious Proceedings of the Larvæ of *Euchæstes egle* Feeding Upon the Milk-weed;" (3) Mr. W. E. Saunders on the English Sparrow, strongly recommending its extermination; (4) Rev. T. W. Fyles on "The Sphingidæ of the Province of Quebec." Mr. Fletcher, in discussing this paper, remarked upon the colours of *Sphinx 5-Maculata*, and said that the dark forms seem to be hardier than the pale green; he had observed also in *Papilio asterias* that the green pupæ emerged much sooner than the brown; he had obtained no less than four broods of this insect this year. (5) Rev. T. W. Fyles read "A Memoir of the Late Philip H. Gosse," and exhibited a photograph of this eminent naturalist and his late residence. (The above papers are all published below.)

Mr. Moffatt stated that he had taken *Papilio chresphontes* this summer at Hamilton, and that he had seen in that neighborhood a specimen of the now rare *Pieris protodice*. Mr. Fyles mentioned that he had taken *Grapta gracilis* and *faunus* at Quebec in September; *Hepialus gracilis* in the Township of Dunham; and *Hepialus auratus* in the Township of Brome. Dr. Bethune had found *Grapta J. Album* numerous at Port Hope in September, and brought some living specimens to the meeting; these will be taken care of during their hibernation, and efforts will be made to obtain their eggs in the spring.

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The following gentlemen were elected members of the Society:—Rev. Prof. Symonds, Trinity College, Toronto; Rowland Hill, London; Mr. Brown, *Free Press*, London; A. L. Poudrier, Donald, B.C.; Arthur M. Bethune, Port Hope; E. M. Morris, Toronto.

It was decided to hold the next annual meeting in London immediately after the close of the meeting of the American Association in Toronto in August.

After passing a vote of thanks to the Mayor and Council for the use of the City Hall, the meeting adjourned.

NOTES ON THE HYPENIDÆ OF THE PROVINCE OF QUEBEC.

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

For the first time since I have resided at South Quebec the hop-vines in my garden have this season been infested with the larvæ of *Hypena humuli*, Harr.

Throughout July the ravages of these destructive insects were continued, and by the end of that month the foliage on the vines was very thoroughly skeletonized. In their attacks on the leaves, the larvæ commenced operations from beneath, biting holes through, and enlarging them till the fleshy portions of the leaves were entirely gone, and only the ribs and veins remained in unsightly tangles.

At the slightest disturbance the larvæ would throw themselves to the ground, and, on reaching this, would jerk themselves about for a second or two, and then remain quiescent, but contorted out of all caterpillar shape. The body under such circumstances is doubled back, the head thrown to one side and the legs protruded from the rounded segments; and, as the under side of the creature is much lighter in colour than the upper, it can readily be conceived that the whole appearance, both in hue and shape, is so changed that even an insectivorous bird would fail to recognize the *bonne bouche* that had so adroitly slipped from under its bill.

When full grown the larva is about eight-tenths of an inch long. It loops slightly in walking. In colour it is pale glassy green. It has a darker green dorsal line and white side lines. The under part of the body and the legs are greenish white. The head is greenish white dotted with black. The larvæ appeared in different stages all through the month of July, and were green in all their stages. I mention this fact because Professor Packard says that when half grown the larvæ are of a pale livid flesh-colour. Difference of climate may have something to do with the variation. Fresh imagos continued to appear all through the month of August and in the first week of September.

For the destruction of the larvæ an application—by means of a syringe—of Paris green suspended in water would probably be found effectual. And, as the larvæ appear before the blossoms of the hop, such an application might be made without fear of injurious consequences. Should the use of Paris green be thought undesirable, an application of strong soap-suds would be found beneficial.

The long protruding palpi of the perfect insects of the genus *Hypena* have suggested the name "Snout," by which the moths are familiarly known. The *Hypenidæ* belong to a group of insects that have been called *Deltoides* from the Greek Delta (Δ)—the outline of a Delta moth in a state of repose resembling that letter.

Characteristics of the Genus Hypena.

Imago:—Antennæ long and filiform; palpi very conspicuous, curved upward at the tip; abdomen slender, sometimes crested on the first and second segments; fore-wings somewhat falcate, bearing scaly tufts on the upper surface.

Larva:—Long, cylindrical, active, has fourteen feet only, loops but slightly.

Pupa:—Slender, pointed, contained in an imperfect cocoon among leaves.

Descriptions of Hypena Moths taken in the Province of Quebec.

Humuli, Harris.—Expanse of wings, 1.2 in. Fore-wing: Grey, sometimes brownish grey; inner line and elbowed line much indented; between them a dark brown patch

extends from the costa for nearly half the width of the wing; a brown dash extends from the farther of the two inward points of this patch to the tip; subterminal line indicated by a row of black dots; on the brown patch and near the inner line are two tufts of black scales; and, near the elbowed line, is another tuft of the same. Hind-wing, grey, bordered by a black dotted line and light grey fringe. Head and thorax, brown. Abdomen, grey.

Achatinalis, Zeller.—Expanse of wings, 1.3 in. Colour, light reddish brown—the hind-wings lighter than the fore-wings. Inner line, slightly curved, brown; elbowed line, white, wavy; the space between forming a band of darker colour. Towards the nearer costal angle of this band is a small black tuft. For about half the distance between the elbowed line and the subterminal line the wing is of a paler and slightly rosy hue; then, extending to the subterminal line, there is a band of dull brown. The subterminal line is wavy, scalloped, interrupted, black with a grey edging. Apical dash, grey.

Perangulalis, Harvey.—Expanse of wings, 1.1 in. Colour, grey varied with light warm brown. Inner line, curved, white, with an outer margin of brown; elbowed line, nearly straight—one slight wave near the costa, white with an inner margin of brown; the space between these lines somewhat darker in colour than the rest of the wing—has one small black dot of raised scales in its inner costal angle; subterminal line, beautifully scalloped, black, interrupted. All the wings are margined with brown. *Perangulalis* is the most beautiful species I have taken.

Vellifera, Grote.—Expanse of wings, 1.4 in. Colour, light warm brown mottled with darker brown. Inner line, sharply indented on the costa; a small tuft of dark scales at the opening of the indentation; elbowed line, slightly wavy, touched by a small dark brown patch at a slight distance from the costa; both these lines are dark brown bordered with a lighter hue; they are connected at their nearest approach to each other by a cross line of brown; subterminal line, wavy and less distinct; a brown cloud extends from the apex about half way along the hind margin.

Scabra, Fabr.—Expanse of wings, 1.3 in. Fore-wings, dark brown of an umber shade; hind-wings, nearly as dark. Inner line, indented, somewhat obscure; elbowed line, with a very marked tooth extending outwardly, not far from the costa. On this line, near the hind margin, are two tufts of raised scales. In the space between the lines there are two such tufts. Subterminal line, wavy.

NOTES ON LARVÆ OF EUCHETES EGLE.

BY J. A. MOFFAT.

On the 20th of August last, whilst strolling amidst a most luxuriant growth of milk weed, *Asclepias cornutus*, I came on a brood of *Euchetes Egle* larvæ, about two-thirds grown, whose movements arrested my attention.

They were situated on three tiers of leaves, the upper one more than half eaten, the second one not so much, the third one not at all; on the two upper ones the caterpillars were in the position usually taken by them when feeding in company, that is, resting on the edge of the leaf side by side, heads all one way, bodies at an acute angle with edge of leaf. When my eye first caught them they were mostly engaged in jerking their heads vigorously from side to side, the pivot of the movement being about the centre of their length, whilst every now and again one and another of them would throw itself off the leaf and fall to the ground, others would start for the opposite side of the leaf, run as if pursued, and go over the edge. Very soon there were none left on the two upper leaves and my attention turned to the lower one, in the hollow of which was a little heap of caterpillars, probably dropped there from the leaves above. As I looked at the confused mass I thought they must be dead; as they remained quite motionless I stirred them with my cane and found them lively enough, their heads all pointing inwards and each as much as possible with its head under its neighbour. I thought of *Ichneumon* as probably the producing cause of such strange conduct. There was a small glossy black Hymenopter running about on this leaf, but during my observations it showed no inclina-

tion to interfere over them. They of them stamped back of its head hair to deal with then brought it d sweeping rapidly one throw itself scratching its ba rubbing only its l

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tion to interfere with the larvæ. Whilst I was watching them a bumble bee flew close over them. They instantly seemed to become frantic, jerking violently, whilst a number of them stampeded, going over the edge of the leaf with a bound. I saw one rubbing the back of its head on the leaf; it seemed to be quite conscious that it had long tufts of hair to deal with. In the operation it raised its head well up, turned it a full half round, then brought it down slanting, bending all the tufts to one side, pressing hard, then sweeping rapidly the other way, and this it did several times without stopping. I saw one throw itself completely over on its back, and wriggle after the manner of a dog scratching its back on the ground, even to the raising of the centre of its body, and rubbing only its head and rump.

THE ENGLISH SPARROW.

BY W. E. SAUNDERS, LONDON, ONTARIO.

The sparrow question, as it is now familiarly termed, has certainly been a much debated one of late, and while not a few persons to whom the bird is an old acquaintance agree that all statements to its detriment are malicious slanders, still the bulk of evidence as well as of opinion is strongly against it, and by almost, if not quite all of those who are in the best position to know, the sparrow is unhesitatingly and sweepingly condemned.

This decision has not been reached without due consideration and ample evidence. Both in the United States and on our side of the line, time and money have been freely spent in solving the problem, although most of the work has been done by our neighbours. Their Division of Zoology, in the Department of Agriculture, issued blank forms containing questions bearing on all points of the subject at issue, and these forms were sent to everybody known to those in charge, who would be likely to possess information of value in deciding the result of the investigation. When the reports were gathered in, it was found that while the sparrow was introduced at only a few points, chiefly along the Atlantic seaboard, it had increased so rapidly that it was fast covering the continent; in fact, last year the new territory reported covered was about 500,000 square miles, which nearly equalled its total distribution for 1886, so that in a few years, probably three at the outside, we shall see it covering our whole continent. One of the greatest objections to its presence is that it crowds out and drives away our native birds, and in this respect the results of its residence among us are even worse than the effects of the summer visits of the cowbird, about whom a few words may be allowed in passing.

It is a matter of public notoriety that the cowbird leaves the hatching of its eggs and the care of its young to the tender mercies of other birds, usually smaller than itself, but it is not so well known that very often this intruder, by its large size and rapid growth, absorbs the attention of its foster parents, and the legitimate occupants of the nest are first starved and then thrown out of the nest, the result often being that when the intruder is full grown it is the sole occupant of the nest, having caused the death of from three to five small birds, any one of whom would far exceed its murderer in usefulness.

Therefore, every farmer would be doing a service to himself if he would endeavor to lessen the number of cowbirds in his neighbourhood, and thereby directly increase his stock of insect-eating birds in the succeeding summer.

There is, however, a bright side to the cowbird question, and that is found in the fact that while the supply of the celebrated reed bird of New York and adjacent cities, consists chiefly of red-winged and rusty blackbirds, the number of cowbirds entering into it is no small one, and as the other birds decrease we may hope to see the latter species form a larger proportion of the total bulk consumed, until its numbers becomes so far reduced that we shall not seriously notice its baneful presence.

But no such hope comes to our relief when we consider the ways of the sparrow. They do not utilize the attentions of other birds to rear their young—if they did there would be a limit to their increase, as there are few nests of our native birds containing eggs after the beginning of July—but this foreign intruder extends its work as long as

the weather is favorable, three or four broods of four to six each being the usual number of young raised in a season, and as it generally breeds in town it is not subject to the attacks of carnivorous birds and animals to the extent to which our native birds are troubled.

Out of a large number of stomachs of adults examined by the writer, so much as fifty per cent. of insects has been found, the proportion varying from this to none, in which latter instances the contents generally consisted entirely of road-pickings and grain. The stomachs of young birds taken from the nest usually contained from one-quarter to one-half of insect remains, but instances are not wanting where stomachs even of unfledged young contained nothing but road-pickings, although the belief that they feed their young to a considerable extent on insects is amply proven. Their numbers in our country are not such as would lead one to believe that they might commit havoc among grain fields, but the record they bring with them from Europe shews this to be their habit, and already reports of great damage to single fields are coming in from different localities, and thus public opinion is being aroused to the probability that they are destined to be a factor in determining the results of agriculture in our country. Reports have reached the writer from different directions around London that they have seriously affected the yield of wheat from certain fields, and it is within the range of the experience of almost every gardener that they sometimes do serious damage to the buds of fruit trees and shrubs, and also that they often attack the ripe fruit itself.

That they cannot be depended on to attack any particular insect every time it appears is shown by a recent letter from the President of our Society, in which, after referring to their attack on a scourge of apple aphid, and stating that he saw one devour a larva of the common tent caterpillar, he says, "On the other hand, when trees have been swarming with *Clisiocampa Americana* (the tent caterpillar), as in 1887, the sparrows flew into the trees in large numbers, but I never saw them touch a caterpillar except in the above-mentioned instance."

Some people in the country realize the fact that this bird is an unmitigated nuisance; one striking case having recently been brought to my knowledge, where a farmer living close to the city limits of London, where these birds abound, goes to considerable trouble to prevent their permanent access to his farm, and as a result the trees around his house and over his farm are inhabited by such birds as the Orioles, Vireos, Tanagers, Warblers and others, whose brilliant plumage, sweet voices and entertaining ways far more than repay him for his expenditure of time and trouble in protecting them, while they render him untiring service in ridding his farm of noxious insects which would otherwise multiply at his expense. On the contrary, other farms with which I am familiar, as a result of indifference, have for their bird music the strident tones of the sparrow, and instead of having the foliage of their trees and shrubs kept in good condition by the ceaseless activity of our native songsters, their houses are made foul, their tempers tried and their crops attacked by this intruder, who takes upon himself the onus of crowding out many and driving out more of the original avian inhabitants.

This state of affairs cannot but cause grave concern to those who have given their attention to the matter, but as yet nothing has been done towards the extirpation of the nuisance beyond recommendations to the public looking to the lessening of their numbers in various ways, such as preventing them from breeding by destroying nests whenever possible, taking down houses put up for their accommodation, as well as those erected for other birds and usurped by the one in question, and refraining from feeding them at all times, which may sometimes result in starvation in winter.

In England, where the bird is indigenous, the damage done of late years has been enormous, and it has been stated by Miss Eleanor Ormerod, in a letter to the *Times*, of January 13th, 1885, that the ravages on wheat have been "estimated by judges of the farm crops in some districts to amount to one-third of the crop," and Miss Ormerod is one of the most prominent economic entomologists in England, and has devoted a large portion of her life to the study of the bearings of entomology on Agriculture, and has included the sparrow in her labours, affecting as it does so largely the results of agriculture in that country. In a paper read before the Farmer's Club, April 30th, 1885, Miss

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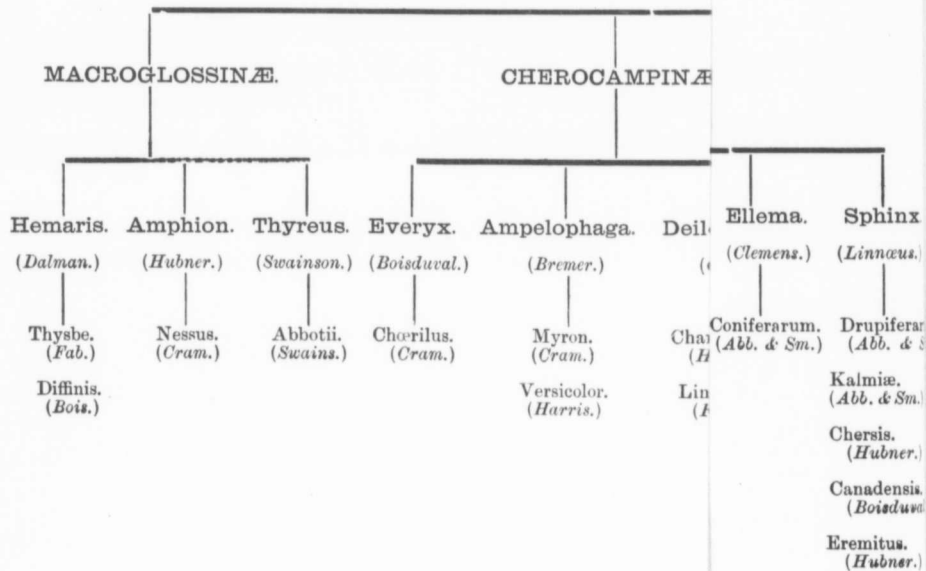
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That the experimenter has no doubt of this bird around the Department of Agriculture in determining the method of preparing the quickest, but most effective, for domestic animals, for roosting purposes.

The best for weight, mixed dry, moisten the grain the poison to adhere.

There is a little attention, which I found was raised, as the birds and their news over the for heads; and the

In view of the fact that as the female, baneful species, the March until the end of the females can be excluded without any special take up this matter not be materially reduced and the more exposed sooner or later, feed though the disgust call for its suppression become immense, as too late, steps will the evil will be witnessed.

NOTES ON

The family Sphinginae of the Lepidoptera. The form and colouring of the wings.

The name Sphinx is given to many of its species.

The perfect insects and shape of their wings and shape of their bodies, of their resemblance to the Sphinx, they are named.

The earliest of the moths (*Amphion nebulosus* Diffinis). These, in the apple-bloom. At Quebec.

I took, at lilacs

Ormerod condemned the sparrow on all counts, judging both from evidence and inference and she strongly recommends it for wholesale slaughter.

That the extermination of the English sparrow would be a great boon to Canada, the writer has no doubt, and for the benefit of those who may wish to lessen the numbers of this bird around their dwelling places, it may be mentioned that the Ornithologist of the Department of Agriculture at Washington has had experiments made with a view to determining the most convenient, efficient and economical poison for use, and the simplest method of preparation. It was found that of the common poisons, strychnine was much the quickest, but arsenic was better suited for the purpose, most birds that were fed on arsenic in the morning dying in the night following, when they would be in their nests or roosting places, and thus their poisoned bodies would not often endanger the lives of domestic animals, particularly in the winter, when they seek the most secluded places for roosting purposes.

The best form of presentation was one part of arsenic to fifteen of cornmeal by weight, mixed dry and fed wet. If whole grain, such as wheat, is used, it is well to moisten the grain with a little water to which some gum has been added, so as to cause the poison to adhere to the grains.

There is a little association in St. Thomas to which the writer would like to call attention, which has been doing good work with small outlay. By private subscription a fund was raised, and the members of the association, mostly boys who have the good of the birds and their country at heart, gave their own captures and services free, and spread the news over the town that so much a dozen would be given for eggs and so much each for heads; and the spread of sparrows in that city promptly received a severe check.

In view of the possibility of similar organizations elsewhere, it may be recommended that as the females are the ones who are most actively engaged in perpetuating the baneful species, the price set on the heads of females in the breeding season, that is from March until the end of August, should be at least double that of the males, as, if the females can be exterminated, it goes without saying that the males will soon die out without any special assistance from man. It is generally held that until the Government take up this matter and vote a sum of money for the purpose, the increase of these birds will not be materially retarded, and certainly the sooner this is done the better for the country, and the more expeditious and less expensive the work will be. That it will come to this sooner or later, few that have given the matter much attention can doubt, as, even though the disgust and inconvenience caused to the residents of cities be not sufficient to call for its suppression, the time is coming when the damage caused to farm crops will become immense, assuming national proportions, and then one might almost say it will be too late, steps will have to be taken, and at an enormous expenditure of time and money the evil will be wiped out.

NOTES ON THE SPHINGIDÆ OF THE PROVINCE OF QUEBEC.

REV. THOMAS W. FYLES, SOUTH QUEBEC.

The family *Sphingidæ* is amongst the most interesting of the families of the Lepidoptera. The large size and graceful outlines of the larvæ, and the beauty, both of form and colouring, of the perfect insects, at once attract the eye and win the admiration.

The name *Sphingidæ* is given to this family because of the habit which the larvæ of many of its species have of curving the body into the attitude of the Egyptian Sphinx.

The perfect insects are called Hawk Moths; their hovering motions and the length and shape of their clean-cut wings have suggested the name. Sometimes, also, on account of their resemblance in shape and movements to the smallest of our feathered summer visitants, they are very appropriately styled Humming Bird Moths.

The earliest of the family to make their appearance are the pretty yellow-belted moth (*Amphion nessus*), and the Clear Wings, or Bee-Moths (*Sesia thysbe* and *Sesia difflnis*). These, in the eastern townships, are often found in company, hovering over apple-bloom. At Quebec they frequent the lilacs.

I took, at lilacs, this spring, a lovely little *Sesia* of the size, and somewhat of the

Ellema. Sphinx

(Clemens.) (Linnaeus.)

Coniferarum. Drupiferarum
(Abb. & Sm.) (Abb. & Sm.)

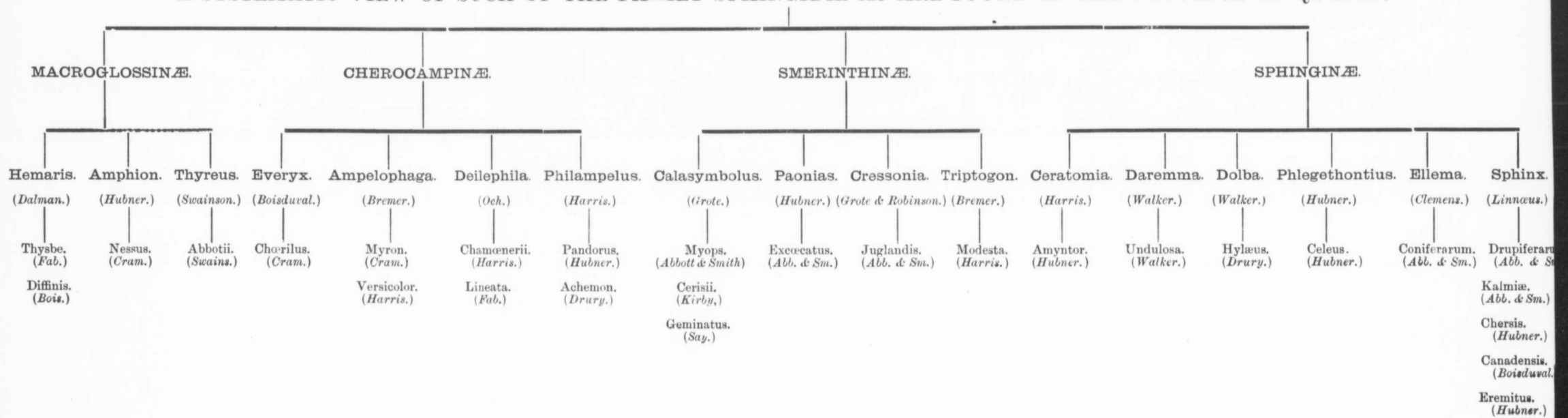
Kalmie.
(Abb. & Sm.)

Chersis.
(Hubner.)

Canadensis.
(Boisduval)

Eremitus.
(Hubner.)

A SYSTEMATIC VIEW OF SUCH OF THE FAMILY SPHINGIDÆ AS ARE FOUND IN THE PROVINCE OF QUEBEC.



appearance, of *Thysbe*. On comparison it is found to have striking peculiarities. Its



FIG. 8.

so as to give the abdomen the appearance of a truncated ending. The usual abdominal tuft is pointed and not flattened, as in *Thysbe*. The under side of the abdomen is reddish brown, with a few white hairs on the sides between the segments. The legs are red throughout. The cell of the primaries has no bar; and the transparent disk of the hind wing has only five veins. Is this insect *Chamaesesia gracilis*?



FIG. 9.

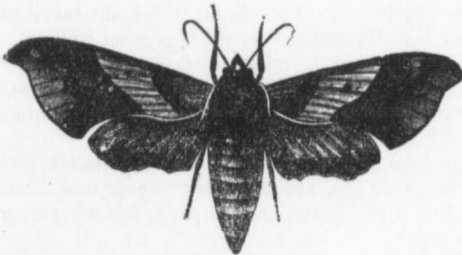


FIG. 10.

antennæ are blue back, and more slender than those of *Thysbe*. The upper part of the head, thorax and basal abdominal segments is of a rich olive green. Between this green and the deep Venetian red of the middle segments of the abdomen is a whitish fringe. Above the eye, and extending to a point half way beneath the hind wing, is a white line, which broadens as it approaches its termination. The under part of the head and thorax is white. A reddish brown patch, extending from the eye to the end of the thorax, separates this from the white line above mentioned. On the sides of the two last segments of the abdomen are tufts of yellowish hairs, those on the last projecting,

Thyreus Abbotii (Fig. 8 represents the moth and caterpillar) is said to have been taken at Hull. I have never met with the insect.

I have found the larvæ of *Everyas chærilus* in the eastern townships, and at Como, on the Ottawa, feeding upon grape-vines. At South Quebec it feeds upon the Virginia Creeper. The larva of *Ampelophaga Myron* (Fig. 9) also, I have found in the townships, feeding upon the grape-vine. The moth is shewn in Fig. 10.

Of *Ampelophaga versicolor* I found one larva and the chrysalis (Fig. 11) in a neglected bottom land in the Township of Brome. It was full fed, and I could not determine its food plant. From it I raised a very perfect specimen of the moth.

Deilephila Chamænerii (Fig. 12 represents the moth), may be found in its larval state feeding upon the



FIG. 11.



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failed. The mo

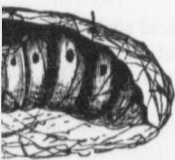


Deilephila
garden at Cow
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eculiarities. Its back, and more of Thysbe. The head, thorax and abdomen is of a rich green and edged of the middle. The venter is a whitish line, which reaches its termination at the head and a reddish brown from the eye to the base of the abdomen. This separates this from the one mentioned. On the last segments of the abdomen are tufts of yellowish. The last projecting, usual abdominal abdominal is reddish. The legs are present disk of the

Fig. 8 represents the larva as said to have been never met with

larvæ of *Everyaz* in townships, and was, feeding upon the leaves of Quebec it feeds upon. The larva of Fig. 9 also, I have seen feeding upon the leaves shewn in Fig. 10. *versicolor* I found in *salis* (Fig. 11) in a garden in the Township of Farnham, and I could not plant. From it I have taken a specimen of the moth. *arii* (Fig. 12) represents the moth. It may be found in the evening feeding upon the



c. 11.

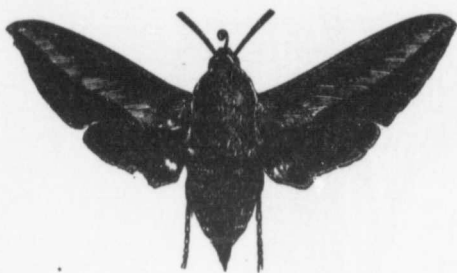


FIG 12.

Willow Herb (*Epilobium angustifolium*). Its favourite haunts are neglected, stony spots in cultivated fields. The instinct of the mother insect leads it apparently away from pasture lands, where there is danger to its offspring from cattle, to the safer spots that I have indicated. In the counties of Brome and Missisquoi the larvæ may sometimes be met with in abundance. I have found them of two prevailing colours—green and madder brown. Those of the latter colour seem to be the more hardy. I have

had no difficulty in raising the moths from them. With the green type I generally failed. The moths may be taken in the evening at lilac blossoms,

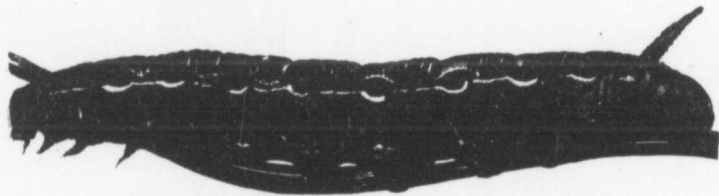


FIG 13.

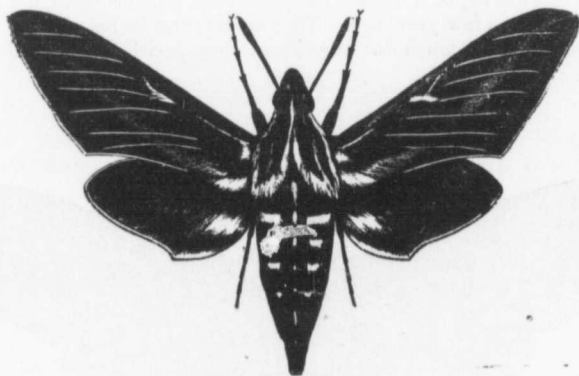


FIG 14.

Deilephila lineata (Fig 13 represents the larva and Fig 14 the moth) frequented my garden at Cowansville, making its appearance about four o'clock in warm autumn afternoons. It was also met with in the grounds of Col. Hall of East Farnham. It has a dashing, rapid flight, and flies low.

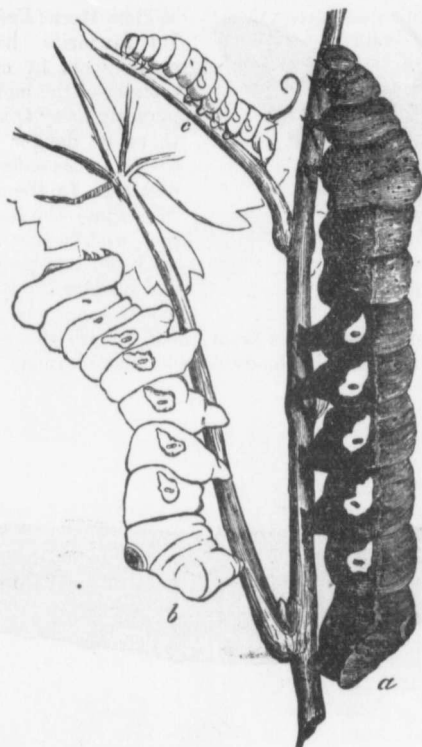


FIG 15.

Two fine larvæ (Fig 15) of *Philampelus pandorus* were sent to me by I. J. Gibb, Esq., of Como, P. Que., a few years ago. They were found in his vinery. Unfortunately the journey by post was too much for them, and they perished. (Fig 16 represents the Pandorus moth.)

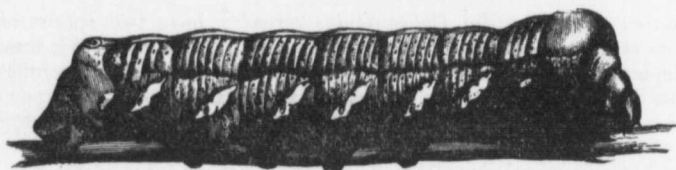
FIG 16



FIG 16.

Philampelus
very abundant
Virginia creeper

Calasymba
cherry (*Prunus*)

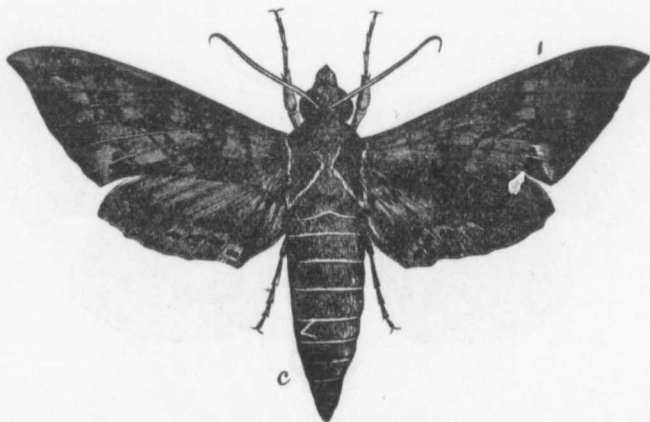


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FIG 17.



FIG 18.



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FIG 19.

Philampelus acherron (Fig 17 the larva, Fig 18 the pupa, and Fig 19 the moth) was very abundant in Missisquoi and Brome Counties, both on the grape vines and the Virginia creeper.

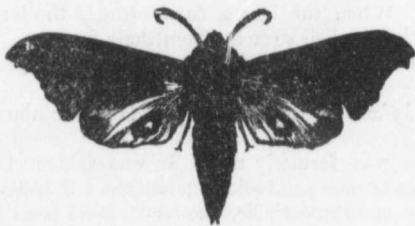


FIG 20.

Calasymbolus myops (Fig 20) is not uncommon. I have found the larvæ on the wild cherry (*Prunus Pennsylvanica*) and have taken the perfect insect at light.

Of the rare and beautiful *Calasymbolus cerisii* I have two specimens (male and female) taken at light, in my bed-room at Cowansville. Concerning this insect, Strecker says (Lepidoptera p. 59):—"This is certainly the rarest of all the heretofore described N. American Sphingidæ; but three authentic examples, all male, are known; the first was figured and described by Kirby, in 1837, who did not know in what precise locality it was captured; this example perhaps may still be preserved in the British museum, otherwise it is probably lost; the second was taken by the late Robt. Kennicott at Rupert House, in British America, and is at present in the museum of Comp. Zool, at Cambridge; this is the largest specimen of the three, expanding about three inches. The third and last, the original of figure 3, I received in a small collection of things from near Providence, Rhode Island."

Calasymbolus geminatus is abundant in Missisquoi county.

Paonias excæcatus is plentiful in the Eastern Townships. The larvæ are found on apple trees; and the moth is taken at light.

Of *Cressonia juglandis*, I have one specimen taken at Cowansville, and another taken at Quebec. Both were attracted by light.

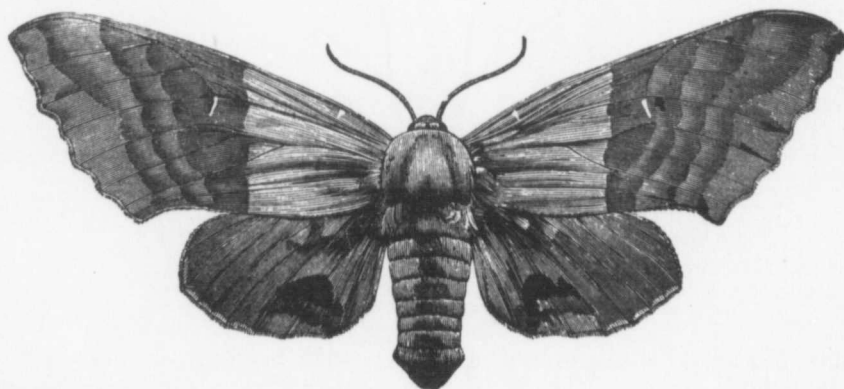


FIG 21.

I have a fine specimen of *Triptogon modesta*, (Fig 21) which was taken at Sherbrooke, P. Que.; and I have seen several other specimens that were captured in the same locality.

I have found the larvæ of *Ceratonia amyntor* in abundance in the Township of Farnham. They feed upon the elm, and their side-lines closely resemble the ribs on the curled leaves of the tree. When the leaves turn brown, the larvæ also change colour, maintaining the illusion that is their security from their foes.

Deremma undulosa I have found in the townships and at Quebec. It feeds upon the ash, etc.

I have taken *Dolba hylæus* in the Township of Dunham abundantly, at flowers after sunset.

Phlegethontius celeus was formerly rare. It was seldom that one came upon the larvæ in the wide expanses of our potato-fields; but since the advent of the potato beetle and the use of Paris green as an insecticide, the larvæ have been frequently found. The fact is, the moth has shunned the poisoned plants, and has laid her eggs on the unprotected potato and tomato patches in our gardens. I have seen as many as fifty full grown larvæ on one such patch of tomatoes in the neighborhood of East Farnham.

I possess one specimen only of *Ellema coniferarum*. It was taken at light at Cowansville.

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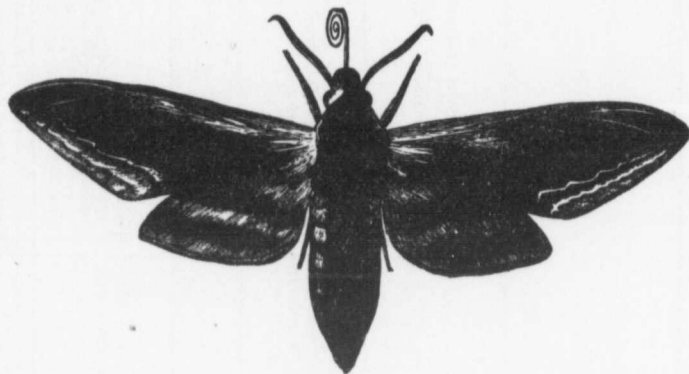


FIG 22.

Sphinx drupiferarum (Fig 22) is one of the most common of our Sphinges. My first captures were from trees and fences on Mount Royal many years ago. I have frequently raised the insect from larvæ taken in different parts of the province. (Fig 23 represents the larva and Fig 24 the chrysalis.)

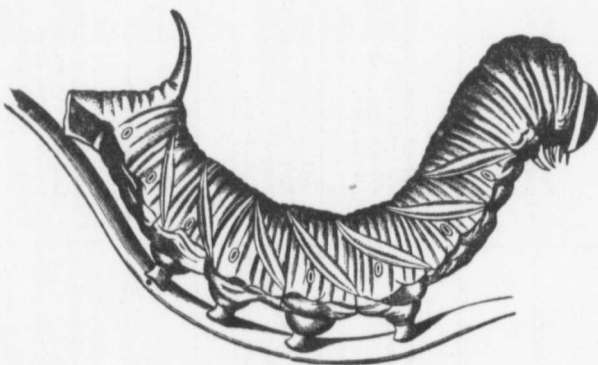


FIG 23.



FIG 24.

Sphinx Kalmia and *Sphinx Chersis* are also common, and may be captured after sundown at milk-weed, perennial phlox, etc.

Sphinx Canadensis is rare. I have four specimens captured at flowers in the dusk of the evening. They were taken in the Township of Dunham.

Sphinx eremitus I have met with only at Cowansville. I obtained a number of larvæ from a bed of garden sage in the grounds of E. Carter, Esq., of that place. I also found the insect upon sage in my own garden, and upon mint (*Mentha Canadensis*) in the neighbouring fields. *Sphinx salvia* would be a better name for the insect than any yet given.

In the following tables I have followed the classification of Grote :

HAWK MOTH CATERpillARS OF THE PROVINCE OF QUEBEC.

A TABLE to aid the Student of Entomology to determine the species of a Hawk Moth Caterpillar, from its food-plant, prevailing colours and particular markings.

NAMES.	Size of full grown larva.	GENERAL COLOUR.	SIDE-LINES AND OTHER DISTINGUISHING MARKS.	COLOUR OF HORN.	FOOD-PLANTS.
Hemaris diffinis	1½ inch.	Blue above, sides pale green, dark red underneath.	Dark green dorsal line, side-lines pale yellow; a transverse golden ridge on either side of first segment.	Black	Bush honeysuckle (<i>Diervilla trifida</i> .) Fever wort (<i>Triosteum perfoliatum</i> .)
Hæmorrhagia Thysbe	2 inch.	Yellowish green, darker on the sides, granulated. Underneath dull rose bordered with buff.	Reddish dorsal stripe. Light yellowish green side stripes. Stigmata red.	Light blue tipped with yellow, and studded with black and white granulations.	Snow-ball (<i>Viburnum opulus</i> .) Snowberry (<i>Symphoricarpos</i> .) Hawthorn (<i>Crataegus</i> .)
Amphion Nessus	3 inch.	Chocolate brown.....	Dorsal and side-lines umber....	Brown	Fuchsia.
Thyreus Abbotii. Larva of male.....	3 inch.	Reddish brown, with patches of green or yellow.	Chocolate - coloured side-lines. Anal shield green and brown.	In place of horn a black tubercle in a yellow ring.	Grape-vine, Virginia Creeper (<i>Ampelopsis quinquefolia</i> .)
Larva of female	3 "	Reddish brown, without patches	Broken sub-dorsal lines. Numerous transverse striæ.		
Everyx Cherilus	2 inch.	Green—whitish on the back..	Oblique side-lines (6 on each side) whitish. Brownish central line on the head. Spiracles orange.	Bluish-green.....	Pinxter flower (<i>Azalea nudiflora</i> .) Spider wort (<i>Tradescantia Virginica</i> .) Grape-vine, Virginia creeper, etc.

Ampelophaga Myron	2 inch.	Pea-green, thickly dotted with yellow.	Side-stripes pale yellow with a dark green margin. Seven red or pale lilac spots, each set in a patch of pale yellow along the back.	Reddish or bluish-green dotted with black, sometimes yellow behind.	Grape-vine. Virginia creeper.
Ampelophaga Versicolor....	2 inch.	Light green, deepening on the	Oblique side-lines, whitish.	Swamp button-bush (<i>Cephalan</i>

Everyx Chœrilus	2 inch.	Green—whitish on the back..	Oblique side-lines (6 on each side) whitish. Brownish central line on the head. Spiracles orange.	Bluish-green.....	Pinxter flower (<i>Azalea nudiflora</i> .) Spider wort (<i>Tradescantia Virginica</i> .) Grapevine, Virginia creeper, etc.
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Ampelophaga Myron	2 inch.	Pea-green, thickly dotted with yellow.	Side-stripes pale yellow with a dark green margin. Seven red or pale lilac spots, each set in a patch of pale yellow along the back.	Reddish or bluish-green dotted with black, sometimes yellow behind.	Grape-vine. Virginia creeper.
Ampelophaga Versicolor....	2 inch.	Light green, deepening on the sides.	Oblique side-lines, whitish. Spiracles light brick-red with white.	Swamp button-bush (<i>Cephalanthus occidentalis</i> .) Swamp Loosetrife (<i>Nesaea verticillata</i> .)
Deilephila chamœnerii	2½ inch.	Brownish olive-green, polished. Head pinkish.	Dorsal line pale yellow. Yellow spots on sides. A pink shield on second segment. Spiracles yellow in black rings.	Red, slightly tipped with black.	Grape-vine. Willowherb (<i>Epilobium angustifolium</i> .) Purslane (<i>Portulaca oleracea</i> .) Evening primrose (<i>Enothera biennis</i> .)
Deilephila lineata	3 inch.	Yellowish green	Dorsal line yellow, sub-dorsal lines yellow and black, enclosing crimson patches.	Yellowish-orange	Purslane, buckwheat, turnip, etc.
Philampelus Pandorus.....	4 inch.	Rich velvety brown, dotted with black.	On each side five cream-yellow patches with black annulations.	Pink, drops off about the third moult.	Grape-vine. Virginia creeper.
Philampelus Achemon	3 inch.	Green at first, afterwards reddish brown.	Along the sides six scalloped cream-coloured patches bordered with white.	Horn drops off leaving a black, polished tubercle.	Grape-vine. Virginia creeper.
Calasymbolus myops.....	2	Bluish green.....	A row of reddish-brown sub-dorsal blotches. Six oblique bright yellow side-lines. Spiracles reddish brown.	Yellow on the sides.....	Wild cherry (<i>Prunus Pennsylvanica</i> .)
Calasymbolus geminatus	2 inch.	Pale green, whitish above, dark green beneath.	Whitish dorsal line. Seven pale yellow side-lines. Dark green anal shield granulated.	Violet.....	Willow.

HAWK MOTH CATERPILLARS OF THE PROVINCE OF QUEBEC.—*Continued.*

A TABLE to aid the Student of Entomology to determine the species of a Hawk Moth Caterpillar, from its food-plant, prevailing colours, and peculiar markings.

NAMES.	Size of full grown larva.	GENERAL COLOUR.	SIDE-LINES AND OTHER DISTINGUISHING MARKS.	COLOUR OF HORN.	FOOD-PLANTS.
<i>Paonias excæcatus</i>	2 inch.	Lightgreen, with pointed white granulations.	Seven oblique yellow lines on each side. Spiracles reddish brown.	Rose-colour—yellow on sides	Apple. Plum, etc.
<i>Cressonia juglandis</i>	2½ inch.	Pale apple-green, granulated.	Seven oblique whitish side-lines edged with crimson beneath.	Brownish, with blackish spinules.	Black walnut (<i>Juglans nigra.</i>) Hickory (<i>Carya alba.</i>) Wild cherry, etc.
<i>Triptogon modesta</i>	3 inch.	Green	Oblique side-lines, yellowish white. Spiracles rust-red.	Purple	Lombardy poplar (<i>Populus dilatata.</i>)
<i>Ceratomia Amyntor</i>	3½ inch.	Pale green, granulated.	Seven oblique greenish white side-lines. Four fleshy notched horns on the shoulders. Spiracles black, circled with yellow.	Green	Elm (<i>Ulmus Americana.</i>)
<i>Daremma undulosa</i>	2½ inch.	Pale green	Seven oblique whitish-green bands bordered with darker green on each side. Fore-legs rose-coloured.	Green tipped with yellow, rose-coloured at base, covered with black spinules	Ash (<i>Fraxinus Americana.</i>) Lilac (<i>Syringa vulgaris.</i>)

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<i>Dolba Hylæus</i>	2 inch.	Pea-green	Oblique side-lines, pink, edged below with white.	Crimson	Black alder (<i>Prinos glaber.</i>) Whortleberry.
<i>Phlegethontius Celeus</i>	3 inch.	Bright green, sometimes brown and even black.	Seven oblique greenish-yellow stripes. Spiracles black, except the two last which are yellow.	Leek-green	Potato, tomato, and other kinds of <i>Solanacea.</i>

Daremma undulosa	2½ inch.	Pale green	Seven oblique whitish-green bands bordered with darker green on each side. Fore-legs rose-coloured.	Green tipped with yellow, rose - coloured at base, covered with black spinules	Ash (<i>Frazinus Americana.</i>) Lilac (<i>Syringa vulgaris.</i>)
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(NEW) Phlegethontius Celeus	3 inch.	Bright green, sometimes brown and even black.	Seven oblique greenish-yellow stripes. Spiracles black, except the two last which are yellow.	Leek-green	Potato, tomato, and other kinds of <i>Solanaceæ.</i>
Ellema coniferarum	2 inch.	Bright green	Dorsal row of bright red spots, having a yellow stripe on either side the row. Lateral stripe white mixed with yellow.	No horn	White pine (<i>Pinus strobus.</i>)
Sphinx drupiferarum	3 inch.	Apple-green	Seven oblique side stripes, white bordered in front with mauve. Spiracles bright orange.	Brown, yellow at base	Plum. Hackberry (<i>Celtis occidentalis.</i>)
Sphinx kalmiæ	3 inch.	Yellowish green	Seven oblique pale yellow side stripes edged with blackish green, and above that with pale blue. Spiracles orange-yellow.	Blue, covered with black tubercles.	Lilac, ash, mountain laurel (<i>Kalmia latifolia.</i>)
Sphinx Chersis	2½ inch.	Bright green	Seven oblique bright yellow side stripes edged with bluish green. Spiracles orange.	Pale blue, sometimes rose ..	Lilac, white ash.
Sphinx eremitus	3½ inch.	Sepia, granulated	Two black shield-shaped blotches. Seven oblique whitish side-stripes. Spiracles black.	Sepia	Sage (<i>Salvia officinalis</i>) etc.

THE HAWK MOTHS OF THE PROVINCE OF QUEBEC.

A TABLE to enable the Student of Entomology to learn the names of the Hawk Moths of the Province of Quebec from the average size, colouring, and distinguishing features of these insects.

NAMES.	Expanse of wings.	PREVAILING COLOURS.	DISTINGUISHING MARKS.
Hemaris diffinis	1 $\frac{3}{4}$ inch.	Wings clear with rosy-brown margins. Body brownish-yellow and black.	Legs black. Under side of body black and pale yellow.
Hæmorrhagia Thysbe	2 inch.	Wings clear with rust-brown margins.	A band of rosy brown, two segments in width across the middle of abdomen. Legs have much white about them. Under side of body light reddish brown and white. Cell of primaries divided by a vein.
Amphion Nessus	2 inch.	Rosy-brown	Crown-shaped tail. Two conspicuous pale yellow bands across abdomen.
Thyreus Abbotii	2 $\frac{3}{4}$ inch.	Dark glossy-brown	Several light dentate markings towards the middle of fore wings. Hind wings lemon yellow with dark brown terminal band.
Everyx choerilus	2 $\frac{1}{2}$ inch.	Reddish, approaching to salmon-colour.	A whitish line along the back of thorax. Basal half of fore-wings lighter than the general colour. A black dot in this lighter portion near the costa.
Ampelophaga Myron	2 $\frac{1}{2}$ inch.	Fore wings olive-green. Hind wings dark salmon-colour with olive-green patches at anal angles.	Basal part of fore-wings <i>lighter</i> in colour than the rest and interrupted by a darker olive-green band. No dorsal line on thorax.
Ampelophaga Versicolor	2 $\frac{1}{4}$ inch.	Fore wings olive-green of a brighter shade than that of the wings of <i>Myron</i> . Hind wings dull salmon colour with whitish inner margin.	Basal part of fore-wing <i>darker</i> in colour than the rest, and interrupted with white markings. A white wavy apical dash on fore wing. A white dorsal line extending the whole length of the body. The underside of this insect is beautifully mottled with green, yellow and white.
Deilephila chamænerii	2 $\frac{1}{4}$ inch.	Olivaceous brown. Hind wings roseate and black.	<i>Two</i> black patches bordered with white on each side of upper part of abdomen. No transverse white lines on fore wings as in <i>Lineata</i> .
Deilephila lineata	3 $\frac{1}{2}$ inch.	Olive-brown. Hind wings roseate and black.	Six or seven white diagonal lines across fore wings. Six white longitudinal lines on thorax.

HAWK

NAMES.

Philampelus Pand

Philampelus Achen

Calasymbolus myo

Calasymbolus ceris

Calasymbolus gemi

Paonias excrucatus

Cressonia juglandis

Triptogon modesta

Ceratomia Amynt

HAWK MOTHS OF THE PROVINCE OF QUEBEC.—*Continued.*

NAMES.	Expanse of wings.	PREVAILING COLOURS.	DISTINGUISHING MARKS.
Philampelus Pandorus . . .	4½ inch.	Olive green	A dark olive green angular patch on each side of thorax, and irregular patches of the same colour on all the wings. On these also are several ochreous markings.
Philampelus Achemon . . .	3¾ inch.	Reddish ash-colour, variegated with light brown. Hind wings pink, with a dark-coloured hind margin.	An angular patch of rich velvety brown with whitish margins on each side of thorax. Three conspicuous patches of the same colour on each fore wing.
Calasymbolus myops	2½ inch.	Brown, with a slight purple blush. Hind wings yellow, with a brown margin.	A black oval spot with light blue centre in the yellow part of hind wing.
Calasymbolus cerisii	3¼ inch.	Grey shaded with warm brown. Hind wings rosy.	A large crescent-shaped white mark on fore-wing. On hind wing a large eye-like spot, consisting of a broad black ring with a spur to the corner of the wing, and an inner white ring with a black centre.
Calasymbolus geminatus . . .	2¾ inch.	Grey, shaded with warm brown. Hind wings rosy.	Two light blue spots in a conical black patch with a spur to corner of the wing.
Paonias excrucatus	2½ inch.	Sienna-coloured with darker markings. Hind wings rosy.	Hind margin of fore-wing much indented. A single light blue spot in an oval black patch on hind wing.
Cressonia juglandis	2¼ inch.	Grey, with sienna tinge and darker markings.	Hind wings of the same hues as fore wings.
Triptogon modesta	4½ inch.	Fore wings greyish-olive, the basal portion conspicuously lighter than the rest. Hind wings dull rosy, with bluish patches at anal angles.	Robust thorax. Grey basal portion of fore wings. Head small. A white dash in a dark olive band in centre of fore wing.
Ceratomia Amyntor	4½ inch.	Fawn-colour and brown. Hind wings clay-colour and brown.	A white or fawn-coloured discal spot with a black dash attached, resting on median nerve. Fringes to hind wings brown cut with yellow.

HAWK MOTHS OF THE PROVINCE OF QUEBEC.—Continued.

NAMES.	Expanse of wings.	PREVAILING COLOURS.	DISTINGUISHING MARKS.
Daremma undulosa	3½ inch.	Grey, mixed with yellowish. Hind wings smoky-brown.	A number of angulated black lines in pairs crossing the fore wings. A white discal spot margined with black, but without the dash seen in <i>C. Amyntor</i> . Hind wings crossed by three parallel dark brown bands. Fringes white cut with brown.
Dolba Hylæus	2½ inch.	Lighter and darker shades of Indian ink, with a tinge of brown.	Numerous zig-zag lines some black and some white. A white spot on fore-wing without the linear prolongations seen in <i>S. Eremitis</i> . Besides the abdominal white side patches so common in the Sphingidæ, two rows of distinct white spots on upper part of abdomen.
Phlegethontius Celeus	4½ inch.	Grey, with a tinge of warm brown.	Five orange spots in black rings on each side of abdomen.
Ellema coniferarum	2¼ inch.	Fore wings bluish-grey with brown markings. Hind wings light warm brown.	A row of conspicuous brown denticulations running inward from hind margin of fore wing. Two black transverse streaks in centre of fore wing. Fringes white.
Sphinx drupiferarum	4¼ inch.	Rich, warm umber	Upper part of thorax very dark, approaching black. Whitish lines on margin of fore wings. Hind wings whitish with median and subterminal black bands and fawn-coloured margin.
Sphinx kalmie	4 inch.	Sienna-colour, resembling wainscot oak,	Fringes to wings conspicuously rust-red, cut with white.
Sphinx chersis	5 inch.	Dark grey, gives the idea of wood ashes.	Several transverse black dashes on fore wings. Hind wings with dark brown or blackish median and terminal bands.
Sphinx Canadensis	3½ inch.	Light grey, with brownish tinge.	Has distinct whitish streaks and black transverse lines on fore wings; also a black line bordered with white extending nearly to the apex.
Sphinx eremitis	3 inch.	Lighter and darker shades of Indian ink, with a tinge of brown in fore wings. Hind wings yellowish white with very broad bands.	On the fore wing a small white dot with a black border and with linear prolongations, several transverse black streaks, and near the hind margin an irregular blackish line edged outwardly with grey.

For fuller information on the Canadian Sphingidæ, I would refer the reader to an excellent paper by Mr. E. Baynes-Reed, published in the Society's Report for 1881. Of this paper I have made free use in drawing up the preceding tables.

T. W. F.

On Thursday, near To 1810, and early in the extensive Newfoundland. living at Cowan Waterville on the winter he took for his first work comparatively no "noisy politics" as it was to the of a class to an Englishman who to use his own view that in Mr. Jacob VIII. of his work in the preface (volume life) he says: "I felt it to be no common studies, . . . a lustre which glared in March, months. His oil Alabama, chiefly 1839, and published August, 1844, had a residence there investigations upon and *An Atlas of* From January Marychurch, with Attached to the houses, etc.

For some years he devoted himself elected a Fellow studying by 4 o'clock producing on the and among the of Mr. Gosse.

Among his *Britannica*; a *h Deep*; *The Roman Forms*; *Land as* Always of studies, and a number. The last of *Expositions* One cannot Philip Henry G.

PHILIP HENRY GOSSE.

On Thursday, the 23rd of August, Philip Henry Gosse departed this life at St. Marychurch, near Torquay, Devonshire. He was born at Worcester on the 6th of April, 1810, and early displayed a taste for Natural History. In 1827 he was engaged as clerk in the extensive mercantile house of Messrs. Slade, Elson, Harrison & Co., of Carbonear, Newfoundland. In June, 1835, he removed with his friend, Mr. G. E. Jacques (now living at Cowansville, P.Q.), to Lower Canada. He bought a farm one mile east from Waterville on the River Coaticook. During the summer he cultivated his land, and in the winter he taught the Compton village school. At this time he collected the materials for his first work, *The Canadian Naturalist*. The rough life of a Canadian farmer in a comparatively new settlement was ill-suited to this young man of refined tastes, and the "noisy politics" and "martial alarms" of the times must have jarred on his ear, attuned as it was to the music of nature. Then, too, the people of the neighbourhood were not of a class to appreciate his studies. They were wont to speak of him as "that crazy Englishman who goes about picking up bugs." It was well for him that, as a naturalist, to use his own words, he could find "gratification in any scene and at any season," and that in Mr. Jacques, in whose house he boarded, he had a congenial friend. In Chapter VIII. of his work he draws a gloomy picture of an Eastern Townships' farmer's life, but in the preface (which breathes the modesty and piety which characterised him through life) he says: "During a residence of some years in the Lower Province the author has felt it to be no common privilege to be able to solace himself by these simple but enchanting studies, . . . and even now the recollection of those pleasant scenes sheds forth a lustre which gilds the edge of many a dark cloud."

In March, 1838, Mr. Gosse left Compton and settled in Alabama for about six months. His observations at this period afforded the subject matter of his *Letters from Alabama, chiefly relating to Natural History*. He returned to England in the spring of 1839, and published *The Canadian Naturalist* during the summer. On the 10th of August, 1844, he sailed for Jamaica to study the Natural History of that island. After a residence there of two years he went back to England, and published the result of his investigations under the title of *The Birds of Jamaica, A Naturalist's Sojourn in Jamaica, and An Atlas of Illustrations*.

From January, 1852, to the time of his death, Mr. Gosse's residence was at St. Marychurch, where he had a delightful residence, which he named "Sandhurst." Attached to this were extensive conservatories, including a vinery, fernery, orchid houses, etc.

For some years he was engaged in preparing works for the S. P. C. K. After that he devoted himself to the microscopic study of the British Rotifera. In 1856 he was elected a Fellow of the Royal Society. He was an indefatigable worker, usually in his study by 4 o'clock in the morning in the summer, and by 6 o'clock in the winter, and producing on the average two works in the year. His books must number about forty, and among the scientific papers of the Royal Society upwards of fifty are from the pen of Mr. Gosse.

Among his works are: *Tenby, a Seaside Holiday; The Aquarium; Actinologia Britannica*; a history of the *British Sea Anemones and Corals; The Wonders of the Great Deep; The Romance of Natural History; Life in its Lower, Intermediate and Higher Forms; Land and Sea, and A Year at the Shore*.

Always of a religious turn of mind, he delighted in Sacred History and Biblical studies, and a number of works of a sacred and historical character proceeded from his pen. The last of these, published in 1884, was entitled, *The Mysteries of God, a Series of Expositions of Holy Scriptures*.

One cannot often point to a life more pleasantly and usefully spent than that of Philip Henry Gosse.

THOMAS W. FYLES.

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G MARKS.

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

The annual gathering of the Entomologists of North America in connection with the meeting of the A. A. S. took place this year in the city of Cleveland, Ohio. While much regret was felt at the absence of many eminent Entomologists who have always taken an active part in the work of the Club, and at the consequent smallness of attendance the meeting was much enjoyed by those who were present, and the valuable papers read were received with great interest.

The first session was held at 9 a.m. in a class-room of the Central High School Building on Wednesday, August, 15th, the President, Mr. John B. Smith, of Washington, in the chair. In the absence of the Secretary (Prof. A. J. Cook, of the Agricultural College, Michigan), Prof. Herbert Osborn, of Ames, Iowa, was requested to act in his place. Owing to the smallness of the attendance the Club adjourned till 1.15 p.m., when the President read his annual address on "Entomological Collections in the United States." In this interesting and valuable paper, which, as well as the other papers read at the meetings of the Club, will, we understand, be published in *Entomologica Americana*, the writer gave an account of all the great collections, both public and private, in the United States. Among general collections he especially mentioned those of Mr. Bolter, of Chicago, and Mr. Henry Edwards, of New York; in Coleoptera he specified the collection of Dr. Horn, of Philadelphia, Mr. Ulke, of Washington, and Messrs. Hubbard and Schwarz, and Lieut. Casey; in Lepidoptera those of Messrs. Henry Edwards, Neumogen, Strecker, Graef, Tepper, Holland, W. H. Edwards, Lintner, Bailey and Meske; in special departments of Lepidoptera, in butterflies, those of Mr. W. H. Edwards, Rev. Dr. Holland and Mr. Bruce; in the Hesperidae, that of Mr. E. N. Aaron, of Philadelphia; in the Sphingidae, that of Mr. E. Corning, of Albany; in the Geometridae, that of the Rev. G. D. Hulst, of Brooklyn; and in the Tortricidae that of Prof. Fernald, of Amherst, Mass. He also noticed many other collections in various orders, for which we must refer the reader to the address itself.

After hearing the address the meeting adjourned till the next day. The following persons were in attendance during the sessions: John B. Smith, Washington, D.C.; Prof. H. Osborn, Ames, Iowa; Prof. F. M. Webster, Lafayette, Ind.; Dr. D. S. Kellicott, Buffalo, N.Y.; Mr. and Mrs. O. S. Westcott, Chicago; L. O. Howard, Washington; J. Mackenzie, Toronto; A. B. Mackay, Agricultural College, Miss.; D. A. Robertson, St. Paul; S. H. Peabody, Champaign, Ill.; Dr. C. V. Riley, Washington; S. B. McMillan, Signal, Ohio; Rev. L. C. Wurtele and Miss Wurtele, Acton Vale, P.Q., and others.

The Entomological Society of Ontario was represented by its President, Mr. J. Fletcher, of Ottawa, and the Rev. C. J. S. Bethune, of Port Hope.

On Thursday, August 16th, the Club met at 1 p.m., and entered upon the consideration of the President's address; this naturally led to a discussion upon the best materials for boxes, etc., in which to preserve collections. Mr. Howard stated that the boxes in the Museum of Comparative Zoology at Cambridge, Mass., had their bottoms made of Italian poplar. Mr. Fletcher asked for the experience of members with poplar, tulip-tree and other woods as regards cracking and splitting. Dr. Riley said that there was no wood that would not split, warp or crack; the only remedy was to have the materials kiln-dried and then soaked in shellac and alcohol. He adopted the form of boxes used in Washington for the sake of convenience rather than otherwise. The cabinets in Europe were not subjected to the same dry heat as in America, and were consequently not a guide to us in this respect.

Mr. Fletcher stated that there are only two noteworthy collections of insects in Canada: (1) That of the Entomological Society of Ontario at London; it is not very large, but is very good as representative of the Canadian fauna, while it contains many specimens from the United States and other countries. The collection of Lepidoptera is especially good and well named, having been revised by Mr. Grote before it was sent to the Philadelphia Exhibition in 1876. In Coleoptera and other orders great care has been taken to have the specimens well named. The collection is open to any one who desires to examine it. (2) The collection of Lepidoptera in the National Museum at Ottawa is

very good. The Capt. Gamble Geological Survey, with little known requisite to specify the should be placed students. For his types, whenever

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very good. The nucleus was formed by the purchase of about 8,000 specimens from Capt. Gamble Geddes, of Toronto. It is now being added to by the officers of the Geological Survey, who bring to it from time to time rare specimens from out-of-the-way and little known regions. There are several private collections of value, but it is unnecessary to specify them. Mr. Fletcher agreed with Mr. Smith that "types" of new species should be placed in some national collection, where they would be accessible to all students. For his part, he should always be glad in the future, as in the past, to place types, whenever possible, in the National Museum at Washington.

A discussion then arose as to what is meant by a "type." Mr. Fletcher understands the term to mean all the specimens actually before a describer when he is making out his description of a new species. Some writers, however, call all specimens types that may afterwards be identified by the describer as agreeing with the originals. Mr. Howard agreed with Mr. Fletcher that only the material before a describer at the time is to be called "type;" other specimens should be marked, "determined by the author." Dr. Riley thought that all the materials determined by an author might be called "types of that species," provided that they do not vary from the original specimens. Prof. Webster considered that all typical material should be placed in some national depository, where it would be perfectly safe, and instanced the loss of the Walsh collection by fire as a calamity to Science. Collectors should be willing to sacrifice their types for the general good of Science. Mr. Smith was also of opinion that only the specimens before the author at the time of making the description are types, and that specimens determined afterwards are not really types. Mr. Fletcher referred to *Chionobas Macounii* as an example. Mr. W. H. Edwards had eleven specimens before him when he described the species; these are types. Most of these specimens were imperfect. During the past summer the speaker had obtained from the original locality a good supply of specimens in perfect order, and although these agreed with the original description perfectly, they should only be labelled as "typical," and he was of the opinion that the describer even would not be justified in labelling them "type." Prof. Osborn agreed with the last speaker.

Thursday, Aug. 16th.—The Club reassembled at 3.30 p.m. Papers by Mr. Clarence M. Weed, on "The parasites of the honeysuckle Sphinx, *Hemaris diffinis*, Boisd." and on "The Hymenopterous parasites of the Strawberry Leaf-roller, *Phoxopteryx comptana*, Fröl.," were read by the Secretary in his absence. Mr. H. Osborn read an interesting paper on "The food-habits of the Thripidae." Mr. Smith gave an account of the collection of W. D. Bruce, of Rockport, N.Y., which was chiefly made in Colorado; it is especially remarkable for the long series of specimens of many species of Lepidoptera. Among others he has *Chionobas bore* in great numbers from the Rocky Mountains, proving it to be distinct from *C. Semidea* of the White Mountains; also an immense series of *Colias eurytheme* in all its varieties, and numbers also of many species of Noctuidæ.

Friday Aug 17th.—The Club met at 9 o'clock a.m. A paper was read by Dr. D. S. Kellicott, on *Hepialus argenteo-maculatus*, which he had succeeded in raising from larvæ obtained in Oswego County, N.Y. It bred in the roots and stems of *Alnus incana*. Mr. Schwarz stated that he had taken the moth near Marquette, Lake Superior, on July 29th, this year. Mr. Smith considered it to be quite generally distributed, breeding in oak, willow and poplar. Mr. H. Osborn read a note on the occurrence of *Cicada rimosa*, Say, in Iowa.

Prof. O. S. Westcott related the occurrence of a large gathering of butterflies about the carcass of a dead dog at Port Arthur, in June last; one hundred and ten specimens were counted, chiefly consisting of *D. archippus*, and some *L. arthemis*, *Colias* and *Melitæa*. In the same locality he captured, July 20 to 23, nineteen examples of *Melitæa*; of these one was *Nycteis*, and seventeen *tharos*, eight of the form *Marcia*, and nine *Morpheus*. He next gave an interesting account of the numbers of *Lachnosterna fusca*, and *gibbosa*, taken at Maywood, Ill., by means of a trap attached to a street-lamp, during the months of May and June, 1887 and 1888. He also gave a list of 1,192 specimens, belonging to 65 species captured in his trap on the night of June 13th 1888; of these 730 were *Agonoderus comma*, and 204 *Lachnosterna gibbosa*.

Mr. Howard gave an account of some recent experiments made under Dr. Riley's direction at Washington, with kerosene emulsion as a remedy for white grubs, the larvæ of *Allorhina nitida*. He stated that the grass had died over large areas of the affected lawn, and the soil was full of the grubs. The affected portion was treated with kerosene emulsion, diluted fifteen times with water, and applied with an ordinary watering-pot; the ground was then kept saturated for some days with ordinary water from a hose. A month afterwards on digging into the part treated, the grubs were found to have descended sixteen inches into the soil, and all had died. In the untreated parts the larvæ were all alive, and only two or three inches below the surface. There was no injurious effect upon the grass, even when the emulsion was only diluted half as much. He considered that the experiment was entirely successful. In the discussion that followed, it was evident that this remedy is much too expensive for adoption on a large scale, and could only be of practical use on a lawn or plot of land of special value. Dr. Peabody stated that Prof. Forbes had found the kerosene emulsion entirely successful against the common white grub (*Lachnosterna*), but as its application cost at the rate of about \$100 per acre, it was far too expensive for ordinary purposes.

The Club met again at 3 p.m. Mr. Fletcher gave an account of his expeditions to Nepigon, Lake Superior, in search of the eggs of butterflies. Very little is known, he stated, regarding the early stages of many of our diurnals; of even so common a species as *Pamphila cernes* they were unknown. In 1885 Prof. Macoun, of the Geological Survey of Canada, collected specimens at Nepigon of a new butterfly which was named after him by Mr. W. H. Edwards as *Chionobas Macounii*; in 1886 and 1887 Mr. Fletcher went to Nepigon in search of this insect, travelling about 1,500 miles on each occasion, but without success. This year he went again early in July, accompanied by Mr. S. H. Scudder, of Cambridge, Mass.; on the first day after their arrival they caught five males; the next day nine females were caught and caged; from these they obtained about 250 eggs. The egg is larger than and quite different from that of *C. Jutta*, which has been found near Quebec and bred by Mr. Fyles. Mr. Fletcher also obtained eggs of *Jutta* at Ottawa and reared the larvæ from them; the eggs were laid on July 1st and hatched on the 16th; those of *Macounii* were laid on the 12th and hatched on the 27th. At Nepigon he and Mr. Scudder obtained the eggs of 14 species out of 16 that they caged. He then gave a full and most interesting account of the methods of capturing, caging and treating butterflies in order to obtain their eggs, and mentioned that he had received very valuable information and aid from Mr. Scudder in the matter. The simplicity of the apparatus employed deserves mention. "Cages for all small species can be made in a few minutes by cutting off the top and bottom of a tomato can and then fastening a piece of netting over one end, either by slipping an elastic band over it or tying it with a piece of string. The female is then placed in it over a growing plant of the species that the larvæ are known to feed upon. These cages had answered well for all the skippers which fed on grass, and the small Argynnidæ. For such species as lay their eggs on the foliage of shrubs or trees bags had to be tied over living branches, care being taken that the leaves were not crowded up, but that they should stand out freely so that the female could lay, if such were her habit, upon either the upper or lower side, or on the edge of the leaves. In this way eggs were obtained of *Nisoniades icelus* and *Papilio turnus*. Another cage for insects which lay upon low plants, and which is easily constructed, is made by cutting two flexible twigs and bending them into the shape of two arches which are put one over the other at right angles with the ends pushed into the ground; over the pent-house thus formed a piece of gauze is placed, and the edges are kept down either with pegs or earth laid upon them. This kind was useful for larger insects than could be placed in the tomato cans. In these eggs of *C. Macounii*, *Colias eurytheme*, etc., had been secured." (*Entom. Americana*, iv. 159). Mr. Fletcher then described the habits of a number of the species collected, referring especially to those already mentioned and to *Pyrameis huntera*, *Pamphila hobomok*, *Mystic* and *cernes*, *Carterocephalus mandan*, *Colias interior*, *Argynnis vialis*, *Myrina* and *bellona*, *Nisoniades persius*, *Fenesica tarquinius*, etc. He also exhibited living larvæ of *C. Mandan*, *P. hobomok* and *mystic* and living imagines of *C. eurytheme* which had emerged since his arrival in Cleveland. At the close of his address

Mr. Smith explained the account.

The next part of the evening was spent in a discussion, in the limits of the New York State Entomological Society, on a particular regulation proposed for the time for the meeting.

The Club has unanimously selected

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Secretary—

Saturday, the steamer on Lake Ontario, including members a much otherwise have shore for about The insect of which who collected in tree, a remarkable as *Emisa longipennis* also collected. *philodice*, *Pieris adian eyes at this and *Pyrameis cernis* mens of *Utetheis* returned to Cleveland next year in To*

ENTOMOLOGY FOR
Gardeners.
8vo. pp 367

It is with reference of this work some book that I collectors to me unable to mention constrained to mention and Spence's Entomology not have what they wanted, though in its treatment We think too that the first two chapters will, we fear, prove to know something and give an address but they are a list

Mr. Smith expressed the gratification all present felt in listening to so lucid and interesting an account from which everyone would carry away many practical and valuable hints.

The next paper was read by Mr. E. A. Schwarz, of Washington, on "The Geographical Distribution of the semi-tropical Floridian Coleopterous Fauna." It was followed by a discussion, in which nearly all present took part, as to what should be considered the limits of the North American fauna, and what species should be included in the fauna of a particular region, reference being especially made to semi-tropical species that are from time to time found in the north.

The Club next proceeded to the election of officers for the ensuing year and unanimously selected the following:

President—James Fletcher, Ottawa, Ont.

Vice-President—L. O. Howard, Washington, D.C.

Secretary-Treasurer—Dr. D. S. Kellicott, Buffalo, N.Y.

Saturday, August 18th.—A most enjoyable excursion was made to Put-in-Bay by steamer on Lake Erie. There was a very large attendance of the members of the Association, including the Entomologists. This pleasant feature of the proceedings gave the members a much better opportunity of becoming acquainted with each other than would otherwise have been the case. Arrangements were made for the excursionists to stay on shore for about an hour, and this time was made good use of by the members of the Club.

The insect of most interest was secured by Mr. Westcott, who collected in large numbers by beating a small spruce tree, a remarkable Hemipteron, identified by Prof. Osborn as *Emisa longipes*. Many galls and parasitic fungi were also collected. Among the butterflies noted were *Colias philodice*, *Pieris rapae*, and what appeared strange to Canadian eyes at this time of year, *Papilio turnus*; *P. asterias* and *Pyrameis cardui* were also observed, and a few specimens of *Utetheisa bella* (Fig. 25) were captured. The party returned to Cleveland much delighted with their day's outing, and separated to meet next year in Toronto.



FIG. 25.

BOOK NOTICES.

ENTOMOLOGY FOR BEGINNERS, for the use of Young Folks, Fruit Growers, Farmers and Gardeners. By A. S. PACKARD, M. D., New York; Henry Holt & Co., 1 Vol. 8vo. pp 367.

It is with much pleasure that we draw the attention of our readers to the publication of this work. For many years past we have been repeatedly asked to recommend some book that would serve as an introduction to the study of entomology and enable young collectors to make a satisfactory beginning in the pursuit. Hitherto we have been unable to mention any single work that would answer the purpose, and we have felt constrained to tell enquirers that they must procure several books, for instance, Kirby and Spence's Entomology, Harris's Insects Injurious to Vegetation, etc. and even then not have what they want. Dr. Packard's new book is certainly one that has long been wanted, though we fear that it is a little too technical in its language and too abstruse in its treatment of some of the subjects to exactly meet the requirements of beginners. We think too that the author has not been judicious in the arrangement of the matter; the first two chapters on the Structure of Insects and their growth and metamorphosis will, we fear, prove rather repellant to one who has collected a few specimens and wants to know something about them and what to do with them. They are carefully written and give an admirable summary of what every student of entomology requires to know; but they are a little beyond the youthful mind, or the uninstructed powers of the ordi-

nary farmer. We therefore strongly advise all beginners who procure this book—and we recommend them to get it without fail—to commence their reading with chapter VI, which contains very interesting and useful directions for collecting, preserving and rearing insects; they might then turn back and read chapters IV and V on Insect Architecture and Insects Injurious and Beneficial to Agriculture. By this time we have no doubt they will have become so deeply interested in the work that they will not be discouraged by the drier details and the harder words in the remainder of the book. The third chapter, which fills over a hundred pages, gives an admirable synopsis of the classification of insects, and should enable a beginner to arrange with some degree of system any specimens that he collects. The author has departed from the usually received divisions of insects and sets forth no less than sixteen orders; this number he obtains by sub-dividing the Neuroptera, Orthoptera and Diptera. To the new orders thus formed, he applies the novel terms Plectoptera, Platyptera, Mecaptera, etc. We feel rather doubtful about their general acceptance and think it a pity that they should have been put forth in an elementary work of this kind before they had been discussed and approved of by entomologists in general. We do not, however, wish to disparage the work; it is certainly a valuable compendium and we cordially recommend it to our readers who are beginners in entomology. The book is well written and excellently illustrated throughout, and must prove a great help to the science by furnishing young students in a convenient form with information that hitherto they could not readily procure.

C. J. S. BETHUNE.

AN INTRODUCTION TO ENTOMOLOGY. By Prof. J. H. COMSTOCK, Cornell University, Ithaca, N. Y. Published by the Author. Part I, pp 234, 8vo. (Price \$2.00).

The autumn of 1888 is certainly a notable one in the annals of North American entomology owing to the publication of so many important works. Last month we drew attention to Dr. Packard's excellent "Entomology for Beginners," and the issue of the first part of Mr. Scudder's grand work on the Butterflies of the Eastern States and Canada. We have now before us the first portion of another admirable work, which is intended to serve as a text-book for students, and to enable them "to acquire a thorough knowledge of the elementary principles of entomology, and to classify insects by means of analytical keys similar to those used in Botany." The first two chapters of the book treat of the characters and metamorphoses, and the anatomy of insects; he next discusses the orders of the Hexapoda, to which the author very properly limits insects. In this chapter he gives his reasons for adopting *ten* orders, the number being made up of the seven generally accepted orders and the Thysanura, Pseudoneuroptera and Physopoda; in adhering so closely to the old classification he states that he has been greatly influenced by a desire to make his book as simple as possible, and "by the belief that an elementary text-book should follow rather than lead in matters of this kind," in which opinion we thoroughly concur. The remainder of this part of the work treats of the orders Thysanura, Pseudoneuroptera, Orthoptera, Physopoda, Hemiptera and Neuroptera. In each chapter is given a general account of the order treated of, an analytical table of the families, a descriptive account of each family with in many cases tabular keys of the genera, and illustrations of the common species. Future parts will complete the discussion of the orders, and furnish chapters on the remedies for noxious insects, directions for collecting and preserving specimens, etc. Judging from the portion before us, we have no hesitation in saying that the complete work will be a most valuable and admirable manual of entomology; in clearness and simplicity of style, in excellence of illustration and in arrangement of matter, it leaves nothing to be desired. We must not omit to mention that the two hundred wood cuts are for the most part drawn and engraved by the author's wife, and are very good indeed; another excellent feature is the marking of the pronunciation of the accented syllables of technical words, which will no doubt in time help very much to a desirable uniformity in this respect.

C. J. S. BETHUNE.

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INSECT LIFE. A monthly bulletin, published by the Entomologist and his Assistants in the U. S. Department of Agriculture at Washington. Vol. I, Nos. 1 to 4; July to October, 1888.

This new periodical "devoted to the economy and life-habits of insects, especially in their relations to agriculture," is a very welcome one indeed. The four parts of thirty pages each, which have thus far appeared are filled with matter of great interest to both the scientific and economic entomologist. With so able and experienced a staff as that at Washington, presided over by Dr. Riley, and with field agents at widely distant points, this new magazine cannot fail to be most useful, and to do good work in the spread of valuable and timely information.

THE BUTTERFLIES OF NORTH AMERICA. By W. H. EDWARDS.

Part IV of the third series has recently been issued. It contains the usual three magnificent plates; the first represents both sexes and several varieties of *Colias Chrysomelas*, the second, the upper and under surfaces of both sexes of the lovely *Argynnis Nausicaa*, and the third fully illustrates all the stages of *Cænonympha Galactinus* form *California*. The letter-press contains much interesting matter on the life histories, in addition to the descriptions of the species.

NEW WORK ON JAPANESE BUTTERFLIES, by H. PRYER.

The task of preparing and illustrating a work upon the butterflies of Japan, after the model of Mr. Distant's *Rhopalocera Malayana*, has been undertaken by Mr. H. Pryer, of Yokohama, who, with persistent enthusiasm for the past seventeen years, has been engaged in collecting the Lepidoptera of the Empire and studying their habits. The work, entitled *Rhopalocera Nihonica*, will appear in three parts, 4to. It is printed upon Japanese "un-tearable paper" made of a curious combination of the fibres of rice straw and silk. The text is in English and Japanese. The plates are drawn upon stone and printed in colours by native lithographers under Mr. Pryer's own supervision, and are truly excellent. The first part, bearing the imprint of the Japan *Mail* office, is before us. The writer, during a recent stay in Yokohama, had the privilege of examining a portion of the MS. of the Second Part and the proofs of the plates which are intended to accompany it. It may be worthy of note that the letter-press of Parts II. and III. will greatly exceed in volume that of Part I.

The Japanese islands, stretching from Shumshu, the northernmost of the Kuriles, in Lat. 50° 40' N. to the Riu-Kiu group in Lat. 24° N., possess every variety of climate from the semi-arctic to the tropical. The islands of the great central group, Yesso, Nippon, Shikoku and Kiushiu, are traversed by lofty mountain ranges and dotted with volcanic peaks, some of which rise from 9,000 to 10,000 ft., and one of them to 12,450 ft. above sea-level. Upon the summits of these mountains perennial winter reigns, while at their feet a semi-tropical vegetation blooms and flourishes. In addition to the wide diversity in climates which prevails in the islands and the contiguity of colder and warmer climates due to the mountainous character of the country, there are more subtle influences at work depending for their operation upon the rainfall and the aerial currents. The atmosphere is characterized in spring and early summer by an excessive humidity, surpassing that of the British Islands, while at other periods of the year there is a well marked "dry season." The result of these various facts, taken into connection with the additional fact that at a remote geological period the islands doubtless were connected with the Asiatic and North American mainland, has been the development of a fauna marked by a wonderfully composite character and revealing to an unusual extent the phenomena of varietal change, and, in the case of the insect tribes, seasonal dimorphism. To these phenomena Mr. Pryer has paid especial attention with the result of ascertaining that not a few of the so-called species erected by recent Entomologists, into whose hands Japanese collections have happened to fall, must be relegated to the great and ever-growing mass

of synonymical species. This is especially true of the genera *Papilio*, *Pieris* and *Terias*, in which seasonal dimorphism reveals itself most strikingly. The course pursued by Mr. Pryer in massing a large number of forms of the species originally described by Linnaeus as *Terias Hecabe* under the name *Terias Multiformis*, Pryer is open to criticism on the ground that the labour of the elder nomenclator should have been respected and his name retained, while the names of later writers should have been adduced as synonyms. Nevertheless the fact seems to be established beyond reasonable doubt that the species lumped by Mr. Pryer under the newly coined name *Multiformis* are all mere local or seasonal variations of *Hecabe*, Linn.

It was the privilege of the writer to spend many days in Mr. Pryer's laboratory, and he can testify to the painstaking care which he has taken to avoid error in his deductions. The most surprising result of breeding is, however, one which is not alluded to in Part I. of the *Rhopalocera Nihonica*, since it was only definitely confirmed during the past summer, viz., the discovery that *Terias Bethesba* of Janson is a dimorphic form of *Terias Laeta* of Boisduval. The entire difference in form of the two has naturally led students unhesitatingly to accept them as widely different species. Careful breeding has established their practical identity.

As the first attempt at a comprehensive and accurate survey of a part of the beautiful insect fauna of "Dai-Nippon," the new work will no doubt be hailed with pleasure by all Entomologists who raise their eyes beyond the narrow confines of their own immediate neighborhoods and seek to ascertain the truth as to the whole of nature.

W. J. HOLLAND.

THE BUTTERFLIES OF SOUTH AFRICA. South African butterflies: A monograph of the extra-tropical species. By Roland Trimen, F.R.S., etc., assisted by James Henry Bowker, F. Z. S., etc. Vol. I: Nymphalidæ; Vol. II: Erycinidæ and Lycaenidæ. London: Trubner & Co., 1887, 8 mo.

All who have studied foreign butterflies at all are acquainted with Trimen's work on the butterflies of Southern Africa, published more than twenty years ago, under the title *Rhopalocera Africae Australis*. It will please them to know that there have recently appeared the first two of three volumes on the same subject, which are based, indeed, upon the old, but wholly rewritten, and with a great wealth of additions, especially on the natural history side. These two volumes comprise the Nymphalidæ, Erycinidæ and Lycaenidæ, in all 238 species. The Papilionidæ and Hesperidæ are to occupy the third volume with about 142 species. It will thus be seen that Mr. Trimen falls into line with all the principal lepidopterists of England in the serial order in which he here places the different families of butterflies, adopting, indeed, exactly the subdivisions and the order Mr. Moore employs in his *Lepidoptera of Ceylon*, which we noticed lately. But he does more than that; for, in a long introductory chapter of 44 pp., he treats of the structure, classification and distinctive characters of the groups, together with their geographical distribution, their habits and instances of mimicry in an excellent manner, such as is very unusual in a work of this nature. It would interest every reader of the *Canadian Entomologist*. So, too, all the families, sub-families and generic groups are characterised with a fulness entirely proportional to the specific descriptions, rendering the work one of the best introductions to a fauna known to me. These descriptions are evidently the work of one who is quite familiar with structure, are not copied from the work of others, but are introduced in language of the author's own, having a special value quite apart from the rest of the work. Nor is this all; for the characters are drawn not simply from the complete stage of the insects, but from the larva and pupa as well, and these same stages are introduced in the generic description. It is unfortunate that he has not included also the egg. The work is illustrated so far by ten octavo plates, one of which is devoted to the structure of the wings, the head and legs of the imago; two to the early stages of a few species, and the remainder to excellent chromo lithographs of the perfect insects. The figures of the early stages are an interesting, though somewhat scanty,

addition to our knowledge of D'Urbania, a species covered with long hairs, been aided by color, so much of his title page as may be indicated the list of South against 197. A corn, is prefixed will soon be issued

CEYLON BUTTERFLIES published under the name of Trimen & Co. 1880

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addition to our knowledge, the most important of which is found in the larva and pupa of *D'Urbania*, a curious genus of *Lycaeninae*, in which the pupa, as well as the larva, is covered with long fascicles of hairs, as long as the width of the body. Mr. Trimen has been aided by collectors and naturalists throughout Southern Africa, to a very great extent, so much so, indeed, that he has added the name of one of them, Col. Bowker, to his title page as joint author with himself; and the help he has received in this respect may be indicated in part by the considerable number of species which have been added to the list of South African butterflies since the publication of his first work, a total of 380 against 197. An excellent coloured map of Southern Africa, south of the tropic of Capricorn, is prefixed to the first volume. We hope the third volume, completing the work, will soon be issued.

S. H. SCUDDER.

CEYLON BUTTERFLIES. The Lepidoptera of Ceylon, by F. Moore, F.Z.S., Vol. I., (published under the special patronage of the Government of Ceylon) London: L. Reeve & Co., 1880-81. 4°.

The butterflies of the East India region appear to be now in a fair way of receiving their due share of attention. We have already called attention to Distant's invaluable work on the Malayan butterflies, and to the hand-book to the butterflies of India and Burnah, by Marshall and De Nicéville. On many accounts neither of these is so important as the earlier work on the Lepidoptera of Ceylon by Frederick Moore, which we desire to introduce to the readers of the *Canadian Entomologist*, principally on account of the very considerable accession to our knowledge of the earlier stages of eastern butterflies which is here given in the plates, and also to draw attention to the notes on the natural history of the insects given by Dr. Thwaites, which are embodied in the text. The work as a whole consists of three volumes; but we speak here of the butterflies only, which are comprised in the first volume, published in 1880-81. It is a large quarto, with 71 excellent coloured plates, in which the early stages are in very many instances figured side by side with the butterflies. Notwithstanding that it is published under the special patronage of the Government of Ceylon, the work is a costly one, and to one residing in the United States an embargo is laid upon its purchase by the fact that the duties upon such a work are so high. This single volume cost me \$15 for duties and transportation alone. Thus is science encouraged with us!

We are here introduced to a new set of illustrations of the early stages of butterflies, many of which are of extreme interest, and these in every family of butterflies. It is the most important and considerable contribution to our knowledge since Horsfield's memorable volume. It is a pity, however, that in many instances no reference is made in the text, either to Dr. Thwaites' notes, or Mr. Moore's descriptive portion, as to the meaning of certain figures which differ strikingly from those of their allies. Thus the pupa of a species of *Cirrochroa* is represented as hanging by its hinder end, as in all *Nymphalidae*, but bent so at the end of the abdomen as to lie parallel to the horizontal branch from which it is suspended, much in the way that we find it in our own species of *Chlorippe*; but there is no appearance in the figure and no mention in the text of any greatly elongated cremaster with its row of hooklets down the side, which in *Chlorippe* stiffens the pupa into what would seem to be an unnatural position. We have some interesting additions to our scanty knowledge of the early stages of the *Lemoniinae* and an unusual wealth of larvæ and pupæ of *Lycaeninae*. Here again is a figure of a species of *Spalgis* hanging by its tail without the median girt, which is wholly anomalous in this subfamily, but, as there is no explanation of the matter in the text, it is to be presumed that it is not meant to represent the insect in its natural position, the more so as the same is the case in a species of *Appias*, one of the *Pierinae*, represented in two figures as hanging by its tail only, while the whole structure of the chrysalis indicates that it must have had a median girt. Very interesting are the figures of the early stages of the *Papilioninae*, which add very considerably to our knowledge, including as they do some figures of the younger stages of the larva—presumably younger from their appendages, though here

again no mention whatever is made of the fact in the text. We call attention also to the interesting figure of *Gangara*, a hesperian living open and unconcealed, as I am informed by Mr. De Nicéville, and which bears long waxy filaments apparently not proper appendages, but as long as the width of the body itself, rendering it an exceedingly conspicuous object.

In the arrangements of families, Mr. Moore follows the rapidly growing company of the best instructed entomologists in beginning the series with the *Nymphalidæ* and placing the *Papilionidæ* just before the *Hesperidæ*. He separates the *Lemoniinae* from the *Lycaeninae* as a distinct family, and places the *Libytheinae* with the *Lemoniinae* as was done by Bates; but he brings the *Pierinae* and *Papilioninae* under one family heading. It has naturally pleased the present writer to see that Mr. Moore has had the courage of his convictions sufficiently to subdivide the old and bulky group so long holding rank as a homogeneous whole, the so-called genus *Papilio*, into a number of genera, including among the seventeen species which he catalogues no less than ten genera, following thus precisely the line which Hubner long ago undertook to establish, and which I adopted in 1872.

SAMUEL H. SCUDDER.

THE BUTTERFLIES OF THE EASTERN UNITED STATES AND CANADA, with special reference to New England, by S. H. Scudder. Imp. 8vo. Cambridge, pp. 1-40 and 105-208, Part I, 1st Nov. 1888.

For some months Lepidopterists and Librarians have been anxiously awaiting the appearance of Mr. Scudder's monumental work on the Butterflies of New England, which, as is well known, has been constantly engaging the attention of this keen observer and careful student for the last 20 years. Through the courtesy of the author we have been favoured with advance sheets and plates of Part I, which is to appear on the 1st Nov., 1888. From the well known high character of Mr. Scudder's past work, doubtless much will be expected by the scientific world of this long promised book. Judging from the number under consideration we believe few will be disappointed. No work has ever appeared, in any branch of science, where such thorough and complete information is given of the objects discussed, nor which has been so copiously and accurately illustrated. An introduction treats, with the greatest detail, of the general structure of butterflies from the egg to the imago, and includes a chapter upon their classification. This is followed by a systematic treatise in which "not only every species," (embraced within the scope of the work) "but also every genus, tribe, sub-family, and family is described and discussed with a fullness never before attempted, except in individual cases, including in each instance not merely the perfect form, but, when possible, the egg, the caterpillar at birth and in the succeeding stages, and the chrysalis, together with the distribution, life-history, habits and environments of the insect, in which a great accumulation of new facts and observations is embodied."

In the part before us we have pages 1 to 40 of the introduction covering the structure of the egg, the caterpillar and the chrysalis, and the beginning of the description of the perfect insect. There is then a break and the pagination continues again at page 105, where the second section begins with a short chapter on the families of butterflies. This is a reproduction, slightly altered, of the table of classification which Mr. Scudder has already published in the *Can. Ent.*, xix., 201, in which he divides the butterflies into *Nymphalidæ*, *Lycaenidæ*, *Papilionidæ* and *Hesperidæ*, an arrangement virtually the same as that given by Bates and adopted by Packard, in which the genera *Eneis* and *Cercyonis* are considered the highest of the butterflies.

At page 109 the systematic treatise begins with the *Nymphalidæ* or "Brush-footed butterflies." With this family, as with sub-families and genera throughout the work, when possible analytical tables are given for their arrangement, based upon the egg, the caterpillar at birth, the caterpillar at maturity, the chrysalis and the imago. The first sub-family is the *Satyrinae*, including six genera, of which *Eneis* is described first. Under each species we find first complete and careful technical descriptive details of

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structure for all the known stages. These are printed in rather smaller type than the rest of the book, a fact which will considerably facilitate reference. Then follows a general description, giving any interesting features in the distribution and habits of the perfect insect and larva, the food plant, variations and enemies, and lastly a list of the points upon which further information is needed.

On page 127 appears the first of a series of essays, of which there are to be over 70 distributed throughout the work, and to which the author has applied the somewhat inelegant title of "Excursuses." These discuss separately all the interesting problems which arise in the study of butterflies (whether of distribution, structure, history, or relation to the outer world), in themselves forming a complete treatise on the life of these insects. These will be a charming feature of the work by means of which a book, which must necessarily contain a large amount of technical scientific description, will be made attractive to many who will subscribe to it merely to possess the most extensive and beautiful book which has ever appeared on the diurnal Lepidoptera of North America. The scope of these may be inferred from the titles of those which occur in the first part.

1. The White Mountains of New Hampshire as a home for butterflies.
2. The clothing of caterpillars.
3. The general changes in a butterfly's life and form.
4. The eggs of butterflies.
5. The modes of suspension of caterpillars.

The species described in the first part are *Eneis semidea* and *E. jutta*, *Cercyonis alope* and *C. nephele*, *Enodia portlandia*, *Satyrodes eurydice*, *Neonympha phocion* and the beginning of the description of the genus *Cissia*.

The nomenclature, we are told in the prospectus, follows the rules of the American Ornithologists' Union. As is well known Mr. Scudder's views upon some points with regard to nomenclature are very extreme, and it must be conceded that he has so far few followers. This state of affairs, however, we anticipate will be changed. After many years of close study upon a special subject by so able a student, the writer, at any rate, is prepared to weigh carefully, without previously condemning them, his views as expressed in this his greatest work.

The illustrations are, as above stated, most profuse, superbly executed, and each is accompanied by copious explanatory text, which will be bound opposite each plate.

The eight plates in part I, are as follows: No. 1 is a beautifully coloured chromolithograph of butterflies, showing in most instances both the upper and lower sides. The complete work will contain about twelve of these plates. The second plate, No. 14, is uncoloured, but is exquisitely engraved, and by some may possibly be preferred to the last. It shows seventeen figures of butterflies artistically grouped. There are to be five plates similar to this. The next plate, No. 18, comprises eight small maps, showing separately the distribution of the different species treated of in part I. There will be fifteen of these sets of maps. No. 46 shows scales of butterflies, and there will be six of this nature. No. 52 gives the heads of butterflies. The work on this plate, drawn by J. H. Emerton, is very beautiful. There are to be eight others like it. No. 67 is the first of three plates showing the micropyles of eggs magnified highly. No. 70 is devoted to magnified figures of young larvæ just after leaving the eggs, and there will be three others like it. No. 93 is a physical map of New England, prepared specially for this work by John H. Klemroth, under the supervision of the Geographer of the U. S. Survey. These, however, do not by any means exhaust the styles of plates which will appear, for in subsequent numbers new sorts of subjects will come forward, all of which will be fully illustrated whenever figures can make the text more intelligible. Special articles upon hymenopterous and dipterous parasites are to be prepared by the able specialists, Messrs. L. O. Howard, of Washington, and Dr. Williston. In fact, all the phases of life passed by the insects treated of as well as the important circumstances connected therewith, will be presented to the reader in the most complete manner possible. There will be about two thousand figures on ninety-six plates, of which over

forty will be coloured. The small inconvenience of not always having all the plates referred to in the text issued at the same time with it, cannot of course possibly be obviated in a systematic work, where everything is treated fully in its proper place under each species, and in which the number of subjects needing illustration in each part is greater than can be shown on the quota of plates for that part. The whole will be issued in a year, in twelve parts, each to contain eight plates and about 150 pages of text.

JAMES FLETCHER.

JOHN ABBOT, THE AURELIAN.

BY SAMUEL H. SCUDDER.

It has been a fortunate thing for the study of butterflies in this country that the earlier students were those who devoted themselves very largely to the natural history of these insects rather than to their systematic or descriptive study. It was indeed a natural and healthy result of the poverty of external resources in earlier times, and I have thought that it would not be devoid of interest to present a few facts concerning the life and industry of one of these earlier naturalists, who worked to such good purpose and accomplished so much under circumstances that would now seem very forbidding.

A unique figure, perhaps the most striking in the early development of natural history in America, is that of a man of whom we know almost absolutely nothing, excepting what he accomplished. With one exception, all our knowledge of his personality comes through tradition. No life of him has ever been written, excepting a brief notice, by Swainson, in the *Bibliography of Zoology*, to which Mr. G. Brown Goode has kindly called my attention. It is not known when or where he was born or when he died, scarcely where he lived or to what nationality he belonged. Even the town where he worked no longer exists. His name alone remains; and though we have access to not a little of his writing in his own round hand, his signature cannot be discovered.*

John Abbot was presumably an Englishman, as the name is English, and he is said by Sir. J. E. Smith to have begun his career by the study of the transformations of British insects. When not far from thirty years old, and probably about 1790, he was engaged by three or four of the leading entomologists of England to go out to North America for the purpose of collecting insects for their cabinets. After visiting several places in different parts of the Union he determined to settle in the "Province of Georgia," as Swainson calls it. Here he lived for nearly twenty years, in Scriven County, as I am informed by several persons through the kindness of Dr. Oemler, of Wilmington Island in that State, returning to England probably not far from 1810, where he was living about 1840, at the age "probably above eighty." It is rumored in Georgia that he owned land there, and all that can be learned of him comes from persons beyond middle life, in that State, who remember hearing their parents speak of him. Col. Charles C. Jones, the Georgia historian, informs me through Dr. Oemler, that "while he remained in Georgia in the prosecution of his scientific labours his headquarters were at Jacksonborough, then the county seat of Scriven County. Here his work on the lepidoptera of Georgia was largely prepared. All traces of this old town have now passed away." It is supposed that he also employed himself as a school master in this place, but this is purely traditional, and his occasional bungling, not to say ungrammatical sentences, rather indicate a lack of schooling on his own part. What we certainly know regarding him is that he entered into relations with John Francillon, a silversmith, in the Strand, London, who had a famous collection of insects and an extensive entomological correspondence. Francillon undertook to supply subscribers with drawings of insects and plants by Abbot, as well as with specimens, the latter of which, says Swainson, "were certainly the finest that have ever been transmitted as articles of commerce to this country; they were

* Mr. W. F. Kirby has kindly made many researches for me at the British Museum, the Linnaean Society, etc.

always sent home fatigable in his re- His general price too much consider- ever, was not a m- field researches w- insect of every lep- drawings are so be- one." It would a- (5th ed., iii., 148) pillar skins and d- same volume.) but also at Oxfor- drawings of insect- stout quarto volu- dated 1792 to 18- Museum through- activity in Ameri- by Dr. Gray of th- to the Natural H- tion, perhaps the- was purchased b- father.*

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always sent home expanded, even the most minute; and he was so watchful and indefatigable in his researches that he contrived to breed nearly the whole of the *Lepidoptera*. His general price, for a box-full, was sixpence each specimen, which was certainly not too much considering the beauty and high perfection of all the individuals. Abbot, however, was not a mere collector. Every moment of time he could possibly devote from his field researches was employed in making finished drawings of the larva, pupa and perfect insect of every lepidopterous species, as well as of the plant upon which it fed. Those drawings are so beautifully chaste and wonderfully correct that they were coveted by everyone." It would appear from a note in Kirby and Spence's *Introduction to Entomology* (5th ed., iii., 148), that "the ingenious Mr. Abbot" also knew the art of inflating caterpillar skins and dealt in them through Francillon. (See many other references in the same volume.) There still exist in various places, principally in the British Museum, but also at Oxford, Paris and Zurich, and in this country, at Boston, large series of his drawings of insects and plants. Those in the British Museum are arranged in sixteen stout quarto volumes, bound in red morocco; each volume has a printed title page and is dated 1792 to 1809, the dates, no doubt, between which they were purchased for the Museum through Francillon from Abbot, and which probably indicate the period of his activity in America. In Boston two similar volumes exist, one of which was presented by Dr. Gray of the British Museum to Dr. Gray, the botanist, of Cambridge, and by him to the Natural History Society where it may now be seen. The other volume is a collection, perhaps the only considerable one which has never passed out of this country, which was purchased by the Society from Dr. Oemler of Georgia, who inherited it from his father.*

In the title page of the last volume of the British Museum series there is a miniature portrait let into the title page which tradition says was painted by Abbot himself, and indeed it bears every mark of this, though there is no memorandum to this effect within the volume; with its peculiar physiognomy it adds considerably to our interest in the original; there seems to be not a little humour in the quaint features and figure, and the spare form hardly gives the figure of robust health which the face would indicate. Abbot probably returned to England about 1810, at an age of about fifty, and our portrait was doubtless painted at about this time, certainly before he left America, since it represents him in the thinnest of southern costumes. There were old persons living in Georgia up to 1885, but since deceased, who knew him, but apparently none now remain.

Abbot's work was by no means on *Lepidoptera* alone, as any of the series of his drawings will show. Dr. Hagen, in speaking of the volume in the British Museum containing the *Neuroptera*, says that all the details are given with the greatest care and that in almost all cases the species can be identified. The same is the case with most of the drawings of *Lepidoptera*, though there is a mark of carelessness in some of the figures of early stages which is not found in others; this is no doubt due to the fact that so many applied for these drawings "both in Europe and America that he found it expedient to employ one or two assistants whose copies he retouched, and, thus finished, they generally pass as his own. To an experienced eye, however, the originals of the master are readily distinguished."

It would hardly appear that he paid more attention to *Lepidoptera* than to other insects. Yet in the Oemler collection alone there are one hundred and thirty-three plates of *Lepidoptera*, nearly every one of which figures a species distinct from the others, and ninety-four of which are accompanied by the early stages. Twenty-two of these are insects figured in Abbot and Smith's work, but the figures of the early stages are in no case identical; they represent the same insect, but in different attitudes. Of these one hundred and thirty-three plates, thirty-four are concerned with the butterflies. The drawings of butterflies in the British Museum are contained in the sixth and sixteenth volumes; the former comprising the perfect insects only, the latter the early stages as well, and in this latter series thirty-six species are figured; while the two Boston collections contain figures of the early stages of all but two of the species represented in the British Museum volume. Swainson states that a series of one hundred and three subjects of *Lepidoptera*,

* Mr. Oemler and Mr. "LeCompte" are both mentioned in Abbot's notes as sending him specimens.

including none published before, was executed for him "with the intention of forming two additional volumes to those edited by Dr. Smith; but the design is now abandoned."

Each set of drawings furnished by Abbot seems to have been accompanied by more or less manuscript, in which the life history of the insect is given in a brief form, with the food plant of the caterpillar and the times of the change of the caterpillars to chrysalids and of chrysalids to butterflies, which shows that Abbot must have been an exceptionally industrious rearer of insects. Indeed the transformations of not a few of our butterflies are even now known only through the observations and illustrations of Abbot. Dr. Boisduval was good enough to present me with three series of manuscript notes entitled "Notes to the drawings of insects," all written in Abbot's own hand, and comprising twenty-seven foolscap pages, rather closely written, and describing the changes of two hundred and one species; of these thirty-eight are butterflies. These, unfortunately, are referred to only by number and by an English name which Abbot himself applied, apparently to every insect of which he furnished drawings, such as the "reed butterfly," the "ringed butterfly," the "lesser dingy skipper," etc., though he occasionally makes use of such names as the "autumnal ajax," "Papilio antiopa," etc., showing his familiarity to a certain extent with Linnean names. As the names and drawings are in some instances kept together, the manuscript of those in which they are not connected is still of use. It appears that nearly all the Georgian butterflies were observed and painted by Abbot, and that of about sixty specimens which he raised he distributed illustrations and notes of the early stages to some of his correspondents.

As is well known by all aurelians one considerable collection of Abbot's drawings was published by Sir James Edward Smith in two sumptuous folio volumes, but these comprise, as far as the butterflies are concerned, only twenty-four species. This work made an epoch in the history of entomology in this country. Besides this Abbot published nothing. The article credited to him in Hagen's Bibliography was by a Rev. Mr. Abbot, who wrote from England in November, 1798, when Abbot was in this country.

JOHN ABBOT, THE AURELIAN.

BY W. F. KIRBY, BRITISH MUSEUM, LONDON, ENGLAND.

In the August part of the *Canadian Entomologist*, pp. 149-154, I notice an article on this subject by my friend Mr. Scudder, and I may perhaps be able to add some additional remarks.

The volume on Exotic Moths, published by Duncan in Jardine's "Naturalists' Library," contains (pp. 69-71) a short account of Abbot's life and works, and incorporates the notice by Swainson, to which Mr. Scudder refers. Swainson remarks, respecting the plates: "M. Francillon possessed many hundreds, but we know not into whose hands they have passed." I may say that this is evidently the set in the British Museum, as every volume bears the book-plate of "John Francillon." There are seventeen volumes (not sixteen); the first fifteen bear the date 1792 on the printed title pages, and the two last volumes 1804 (not 1809). The contents are as follows:—

- Volumes 1-4—Coleoptera.
 - 5—Orthoptera, Hemiptera, Homoptera, and Heteroptera.
 - 6—Lepidoptera Rhopalocera.
- 7-11—Lepidoptera Heterocera.
- 12—Neuroptera, Hymenoptera.
- 13—Diptera.
- 14—Arachnida.
- 15—Myriopoda, Mallophaga, Acarina, Crustacea, Lepidoptera, (transformations), etc.
- 16—Portrait, Orthoptera, Coleoptera (transformations), Lepidoptera (transformations).
- 17—Lepidoptera (transformations).

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The drawings of transformations of *Lepidoptera* are rarely, if ever, duplicates of those published by Smith, sometimes representing a different variety of the larva of the same species; and they are nearly three times as numerous. There are only about a dozen drawings of transformations of *Coleoptera*. Among the lesser known orders there is little doubt that many species figured are still undescribed.

I fully expect that some of Abbot's correspondence will be discovered (of course including his autograph), perhaps at the Antipodes, for Swainson left England towards the close of his life, and died, according to Hagen, in New Zealand in 1856.

I am surprised that Mr. Scudder has not mentioned the volume of Abbot's drawings presented by Edward Doubleday to Dr. T. W. Harris. (Harris, *Entomological Correspondence*, p. 123.) If this volume is the same as that said by Mr. Scudder to have been presented by Dr. J. E. Gray to Dr. Asa Gray, some error must have arisen. Possibly it came into Dr. Asa Gray's hands directly or indirectly from Dr. Harris, with an erroneous impression respecting the original English donor.

There are a number of specimens originally collected by Abbot in the British Museum and probably in other collections. The Museum of the Royal Dublin Society (now known as the Dublin Museum of Science and Art), contains a large series of bleached specimens of insects of various orders (*Lepidoptera*, *Neuroptera*, etc.), which were not improbably collected by Abbot (cf. some notes by Mr. McLachlan, *Ent. M. Mag.* X., pp. 227, 228.)

NOTE BY MR. SCUDDER.—The small volume of paintings referred to by Mr. Kirby is in the library of the Boston Society of Natural History, and was not mentioned by me because the less said about it the better. It was picked up at a book-shop, bears the date 1830, and though Doubleday paid seven guineas for it, it is certainly not the work of Abbot but of a very inferior copyist, some of the paintings being the merest daubs. It has scarcely the least value. The notice by Duncan I had not seen, but I find that it adds nothing to the facts of Abbot's life. Either I have never seen the seventeenth volume of Abbot's drawings at the British Museum referred to by Mr. Kirby, or, if it concerns the moths only, may for that reason have taken no notice of it. My memorandum of the dates must have been incorrectly copied.

A CHAPTER ON THE LITERATURE OF BUTTERFLIES AND MOTHS.

BY A. R. GROTE, A.M.

Neither Butterflies nor Moths are mentioned in the different accounts of Creation contained in the first chapters of Genesis. As the Hebrew wants a distinctive term for them they may be intended and generally included under that of "flying things." The eastern people had no understanding for the western rage for classifying Nature; and the modern type of a collector "coveting" specimens and breaking the commandments to obtain them, had it been known to Bible writers, would have been doubtless held up by them to execration. "The earth is the Lord's and all the things therein;" this is the leading Semitic notion, and the Jews regarded all Nature as subordinate to the great question of religion. The Arabs followed suit and, under Mohammed, devoted themselves to the propagation of the belief in the unity of the Deity and to a philosophy too grand to include the minute study of such trifling objects as insects. But the old heathen Greeks and the poets were attracted by the butterfly's wings. With them they adorned the shoulders of Psyche. Love and death they winged like birds. Christianity, absorbing and modifying all the old heathen thoughts and customs, seems to have seen, in its earliest Roman days, a religious allegory in the life of the butterfly. To its eyes the caterpillar represented this mundane existence, the chrysalis the last sleep and the tomb, while the soaring butterfly was the soul, winging its eternal flight through heaven. During the Middle Ages people generally were too much occupied with dogmatic philosophy to pay attention to nature, but in Holland, a country which had greatly suffered under the Inquisition and the Spanish rule, at length awoke a passion for insects and for flowers. With the beginning of the sixteenth century the Swiss Conrad Gesner was born, the first naturalist who commenced the formation of a cabinet of Natural His-

tory upon a systematic plan. His work on plants and animals appeared 1550 to 1565, but he does not seem to have written on insects. At this time the discoveries of the Dutch and Portuguese in Asia, and above all, those of the Spanish and English in America, could not fail to draw attention to the brilliant tropical butterflies, and in the seventeenth century the European museums, especially those of Amsterdam and Leyden, already contained collections of them. The discovery of the microscope, which, though claimed by Italy, may well be Dutch, turned the attention of naturalists to the study of insects, no less than to physiology, and the works of Malpighi, Leeuwenhoeck, Ray, Swammerdam, Reaumur, were in turn given to the world. At the beginning of the eighteenth century (1719) a Dutch woman, Madam Sibylla Merian, published an immense quarto book with plates on the insects of Surinam, especially figuring the butterflies and moths, and this work was well known to Linnaeus, and seems to have excited and inspired his entomological studies, as he frequently alludes to it and cites the figures which are, however, but coarsely executed. I have named the Hawk Moth (*Dilophonota Merianae*), which occurs in Texas, Mexico and Cuba, after this accomplished lady and intrepid naturalist, whose travels at that early period were undertaken at much personal inconvenience, and whose enthusiasm seems to have carried her through many obstacles. I like to think that in science we owe much to the gentler sex; it is certain that Madam Merian in her American and, much later, Frau Lienig in her European collections, gave great impetus to the study of butterflies and moths. This interest of woman in all that concerns man is only natural, and if we look around us to-day we shall see that it continues in the matter of entomology.

With the middle of the eighteenth century appeared the works of the Swedish naturalist Linné, or Linnaeus, and the principles of modern nomenclature in Natural History were founded. Linné is the inventor of the system of binomial nomenclature, that system by which each species or kind of animal or plant receives a double Latin or Latinized name, the first being that of the genus to which the *species* belongs, the second that of the species to which the *individual* belongs. Under the law of priority the first such name proposed in print for a species, and which is accompanied by means for its adequate identification, remains its proper specific title, although, owing to our shifting conclusions as to the limit of genera, the first of the two names, or the generic title, may become changed. In this way a durable system of nomenclature is being gradually prepared for all kinds of plants and animals and the command given to Adam is being practically carried out. Owing to the inability of certain writers to express themselves intelligibly, or their want of experience, some names fall by the way and are lost. The sticklers for the law of priority are at great pains to construct a hospital for these defective or forgotten titles, and some confusion and quarrelling results from the effort to reinstate them in their undoubted right. But argument of some sort or another is the natural mental exercise of man, and literary disputations of this kind are among the most harmless.

The thought which culminated in the system of Linnaeus is probably very old. The ostensible father of the philosophical view which produced it is Aristotle, who seems to have held to the opinion that each animal had always reproduced itself after its kind. The world, started after a certain fashion, remained true to the original impulse. And the Creator or Creators of the universe was God or the Deities, according as the belief in the unity or plurality of the supernatural prevailed. We have in this way a chain of naturalists from ancient times, of which certain prominent links were Aristotle, Gesner, Linnaeus, Cuvier, Agassiz. But from quite early times another school of thought had arisen which taught that this is a world of change, and that the animals and plants of to-day are essentially different from those of former times and will in their turn give place to others in all probability; that there has been no original creation out of nothing and that the formation of new kinds of plants and animals is the result of certain natural laws equivalent to those governing inorganic nature. The links in this chain are Democritus, Lucretius, Averroes, Oken, Lamarck, Wallace, Darwin, Spencer. Here it is not necessary to enter into the matter any further than the subject demands. For a hundred years after Linnaeus, from whose tenth edition of the *Systema Naturæ* (1758) the study of the species of butterflies and moths practically commences, Entomologists

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were busy in sorting and naming their material, without a thought but that they were arranging organisms patterned after the original designs of the Creator. Oken, indeed, made the statement that every insect begins its life as a worm, continues it as a crustacean and finishes it as a perfect insect, but the full significance of this progression, which can be observed in the lifetime of a single individual, was for a long time neglected. It furnished at first only material for a kind of metaphysical Natural History, in which certain fossils, standing in a certain structural relation to existing animals, were called "prophetic types," and Biblical and figurative language was fashionably employed to obscure the fact of direct descent. Butterflies and moths, next perhaps to plants, have always succeeded in eliciting much attention from naturalists, and it is owing primarily to his study of them that the English entomologist, Wallace, then (February, 1855) collecting in Borneo, wrote his celebrated article on the law regulating the introduction of new species. This paper endeavored to show that every species has come into existence coincident both in time and space with a pre-existing closely allied species. In further communications Mr. Wallace explained the protective resemblances between animals on the theory of mimicry, and everywhere throughout his valuable contributions butterflies and moths illustrate his remarks and suggest his ideas. Afterwards Mr. Darwin's celebrated book fully and completely showed the action of the law of Natural Selection throughout organic nature, and here also many important results are drawn from studies of the *Lepidoptera*.

The study of the literature of butterflies and moths since 1758 is necessary to the student who is emulous of describing new species or adding to our stock of information. A brief sketch of that branch which treats of the moths of North America may therefore

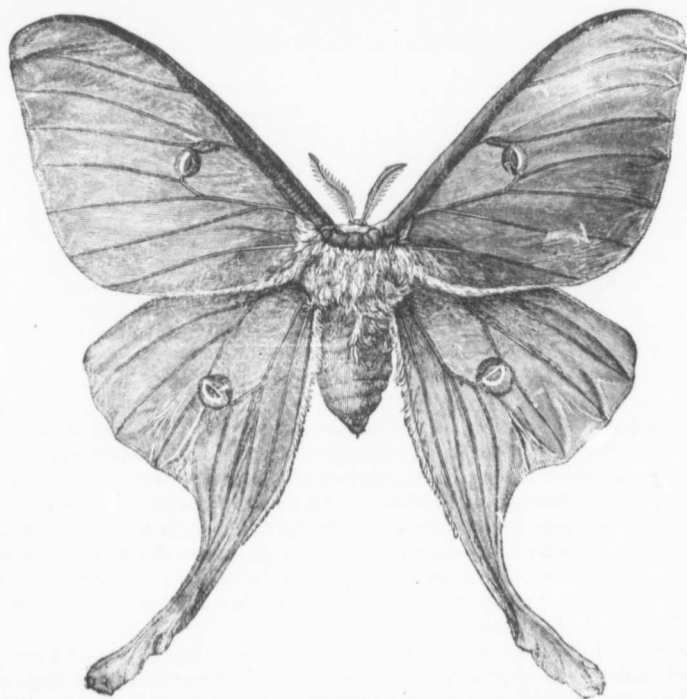


FIG. 26.

be given here. The descriptive works of Linnæus were followed in England by the publication of the illustrated works of Drury (1773), in which good figures of a number of our species are given, all of which are, I believe, recognized, and the names taken into our lists. As his species are all redescribed and figured in modern literature, his original

work has lost much interest. Among the waste of public money for scientific purposes I may mention the fact that the volume in the Natural History of New York, published by the State, contains actual copies (and poor ones) of Drury's old figures, without acknowledgment and this while the originals were flying about in the country all round the capital at Albany. While Drury was publishing his work in England, on the continent Fabricius, who followed very closely in Linnæus's footsteps, issued several descriptive works on insects and in them are the descriptions of a number of our North American moths. Naturally our larger and gaudier species were the ones to be first described. Linné had named our "American Moon Moth" or "Queen of the Night," *Actias Luna* (Fig. 26), as also the "American Emperor" or "Cecropia Moth," *Platysamia Cecropia*

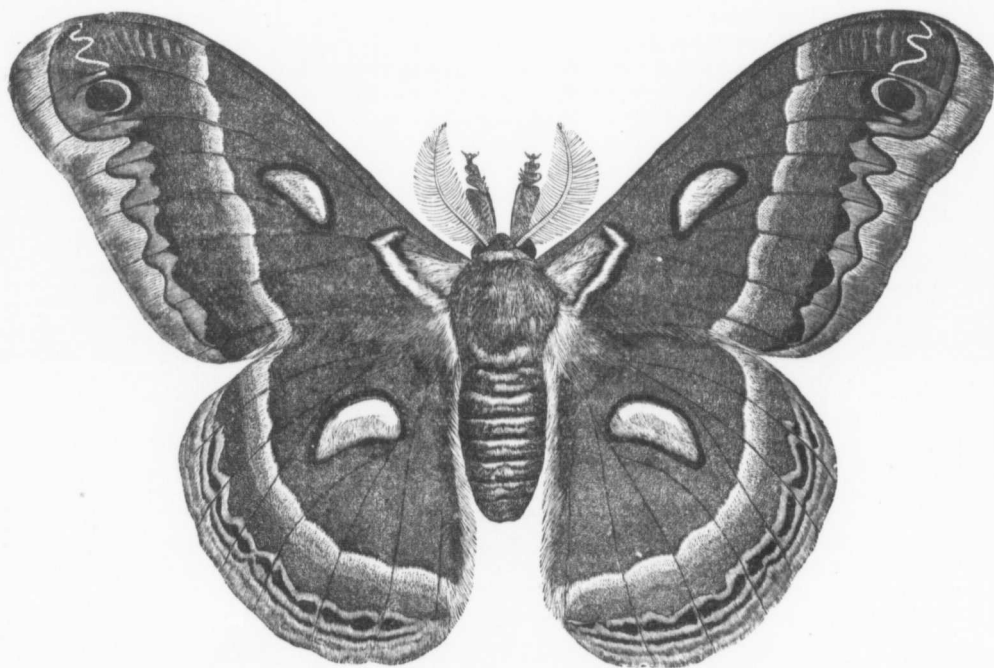


FIG. 27.

(Fig. 27). So far as the titles themselves are concerned, their choice depends on the fancy of the describer, and while Latin adjectives expressive of some characteristic marking or designating the country or the food plant were generally used, names out of Homer and the Classics were brought into fashion by Linnæus's example. Dr. Harris introduced a new feature into our nomenclature, by using the names of Indian chiefs for our *Hesperidae*. The name used for a species soon loses its signification apart from the object it designates. Respecting the name *Cecropia*, Dr. Harris says, on page 279 of the first edition of his book on the Insects of Massachusetts, that this was the ancient name of the city of Athens, and thinks it here inappropriately applied to a moth. But the late Dr. Fitch has written in his copy of Dr. Harris's work, now in my library, "Cecrops was the first king of Athens—*Cecropia* is the feminine of *Cecrops*—and thus implies the first queen of the most polished or fairest people, so a more appropriate and beautiful designation could not have been found for this most gaudy sumptuous moth." So far Dr. Fitch. It may be said that the multitude of species renders it difficult to find different and opposite names. I may close these remarks on the names of insects by referring to a very valuable paper on "Entomological Nomenclature," by the late Dr. Leconte, and published in the sixth volume of the *Canadian Entomologist*, pp. 201 and following. For his

observations Dr. L. Worte! The doct this motto. "Use but never believe you avoid (mere) after truth is liable tive natural histor perform, and that a weed, a bug or a case. In addition tionally obscured review of the olde Walnut Moth," p been identified, su and this is the cas

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observations Dr. Leconte has chosen a motto out of Goethe: *Im Ganzen-haltet euch an Worte!* The doctor advises Entomologists to disregard the advice of the devil given in this motto. "Use words only to acquire and convey accurately your knowledge of things; but never believe that the word is superior to the thing which it represents. Thus will you avoid (mere) scholasticism, one of the great abysses of thought into which the seeker after truth is liable to fall." The doctor concludes his essay by the statement that descriptive natural history is the lowest and most routine work that a man of science has to perform, and that to aim at distinction by having one's name printed in connection with a weed, a bug or a bone is an ignoble ambition; and this is certainly a sound view of the case. In addition, if one's name happens to be a very common one the identity is additionally obscured when the name appears after a Latin title of a species. To resume our review of the older authors: Fabricius (1775) was the first to describe the "Royal Walnut Moth," probably our finest spinner. One or two of his descriptions have not been identified, such as his *Bombyx Americana*, *Pyralis Lactana*, *Tinea Sepulcrella*; and this is the case also with Linné's *Phalœna Omicron*.

The next work of importance to the American student is that of Cramer, a Dutch Entomologist whose volumes (1779 to 1782) contain a great quantity of coloured figures without any systematic arrangement and for the most part coarsely executed. Cramer figures and names for the first time several of our Hawk Moths, such as the species of the genus *Everysa*, *Chœrilus* and *Myron*, the larvæ of which feed on azaleas, grapevines and the Virginia Creeper. Both Cramer and Drury figure our North American species only incidentally, with other so-called exotic material. But in 1779 appeared the large folio work in two volumes by Abbot and Smith exclusively on the Lepidoptera of Georgia, which geographical name then covered a larger area of North America than at present. The materials for this work were the collections, coloured drawings and observations of Abbot, an English schoolmaster residing in Georgia, and thus the South became historically the scene of the earliest studies of our butterflies and moths. Afterwards Major Leconte continued Abbot's work in the same field, publishing upon the butterflies together with the French Lepidopterist, Dr. Boisduval. Abbot's original drawings, which I have had the opportunity of examining in the British Museum, are much better than the published plates, which nevertheless are superior to anything issued before that time, if we except certain figures by Dutch Entomologists of European species. Abbot gives us the species in the three stages of caterpillar, chrysalis and perfect insect, together with the food plant. The text, in English and French, is, however, totally, or almost valueless, if intended to supplement the drawings and render the identification of the species certain. Some of the species cannot yet be satisfactorily made out, while it seems probable that in two instances, *Catocala amasia* and *Homoptera calycanthata*, Abbot has given two distinct species as the sexes of one and the same form. In 1874 I rediscovered the *Phalœna Chionanthi* of Abbot and Smith, in a collection of Noctuidæ sent me from Ithaca, N.Y., by Professor Comstock, of Cornell University. This species had not been even again alluded to in print, so far as I was able to ascertain, since 1797, a long space of time, and had I been less familiar with the literature of our moths I should have fallen into the error of redescribing it. The *Phalœna Chionanthi* of Abbot and Smith is now the *Adita Chionanthi* of our lists; the moth being one of the Noctuidæ and affording a new generic type allied to the genus *Agrotis*. Abbot's unpublished drawings contain representations of several species subsequently described, and were probably not issued because only the perfect stages are represented. Among these drawings is one of the rare *Citheronia sepulcralis*, Grote and Robinson, our second species congeneric with the Royal Walnut Moth collected plentifully by Mr. Koebele in Florida. The species of Abbot's, which I have not been able satisfactorily to identify, are *Aceris*, *Hastulifera* and *Calycanthata* among the Noctuidæ, while I originally showed that his *Vidua* is not the species described afterwards by Guenée under this name, altered to *Viduata* in the supplement to the last volume on the Noctuidæ in the "Species Général." I will here state that I am of opinion that we should reject the name of *Viduata*, altogether, because this is only a slight alteration of Abbot's name and is intended to apply to Abbot's species by Guenée. Now, in my original essay I showed that Guenée's species was not Abbot's but *Desperata*, very probably. Accepting this we must use a new name for *Vidua* and *Viduata* of

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Guenée, an insect I have fully described in Proc. Ent. Soc. Philadelphia, 1872. I shall call this stouter species *C. Gueneana*, and call the *C. Desperata* of Guenée and our collections *C. Vidua* of Abbot and Smith. Resemblances to European forms led Abbot into some mistakes, which have probably not been adequately corrected by Dr. Harris, but wait full collections from the South and detailed comparisons in all stages with the allied forms. Abbot and Smith's has been long our most important work on our butterflies and moths, small as is the number of species illustrated. This arises from the fact that all stages of the insects are given, and it has become in this respect a model of what an illustrated work on the Lepidoptera should be. It is only recently excelled by the magnificent volumes of Mr. W. H. Edwards on our butterflies. Among our larger and interesting moths first figured by Abbot are the Blind Hawk, *Paonias excacatus*; the Brown Eyed Hawk, *Calasymbolus myops*; the Walnut Hawk, *Cressonia juglandis*; the Laurel Hawk, *Sphinx kalmia*, (Fig. 28.)

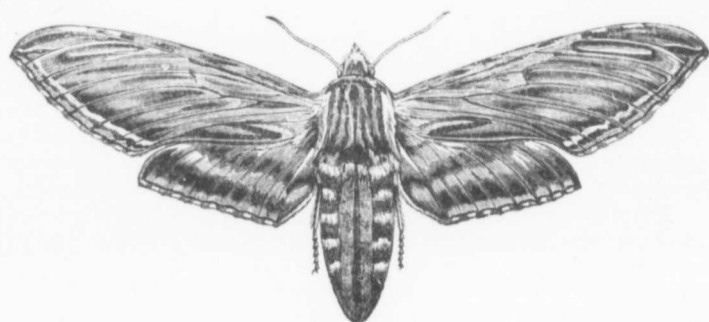


FIG. 28.

After Abbot, the most important work is that of Jacob Hübner, a German naturalist of Augsburg, who has published a number of works on the Lepidoptera, splendidly illustrating a very large number of species. Scattered in other books on Lepidoptera issued at the close of the last, and beginning of the present century, may be found single North American species. Such are, for instance the works of Stoll, De Beauvais, and Esper. Hübner's principal works are, the "Sammlung" and the "Zutraege." The "Sammlung" bears the dates 1806 to 1825; but it seems certain that a few plates were issued at various dates of the last volume, by Geyer, up to 1837, after Hübner's death. According to a written statement given me by Dr. Herrich-Schaeffer, a literary successor of Hübner, and owner of the original plates, these posthumous plates did not include any of the North American species issued by Hübner, and afterwards re-named by Dr. Harris, but I do not feel certain that this statement was complete. It is only so far as these few species are concerned, that the question has any practical bearing for us. Hübner figures four of our hawk moths *Sphinx chersis*, *Ceratonia amyntor*, *Philampelus pandorus*, and *Phlegethontius celeus*. Dr. Harris erroneously describes *Pandorus* under the name *Satellitina* of Linné, which is a West Indian species distinct from ours; and *Celeus* under the name of *Carolina* of Linné, a different species; and gives new names to the two first. But as Dr. Harris re-describes several other species of Hübner, and, in fact, does not allude to Hübner at all, I agree with Dr. Morris, that Hübner's were not then known to him; as authority for the genus *Xyleutes*, Harris quotes Newman, not Hübner. It is evident that Hübner's names for these hawk moths have priority, and they are accordingly preferred in our lists. So far as the names are concerned, Geyer retained the names for the species proposed by Hübner, as he tells us in the *Zutraege*, and as to the plates of the *Sammlung*, he evidently only finished and issued those already determined for publication by Hübner, whose name alone appears as the author of the *Sammlung*. It is probable, and indeed certain, that the plate of *Amyntor* was really issued not later than 1837, the latest date given by Dr. Herrich-Schaeffer; Dr. Hagen makes it 1838, which in any event ante-dates Harris. That Dr. Harris only gradually became acquainted with the

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older authors, is evident from his having at one time re-named *Calasymbolus astylus*, as *S. integerrima*; so that Harris's synonyms in the *Sphingidae* are rather numerous. Dr. Hagen's argument that Dr. Harris knew Hübner, and rose superior to his illustrations, deliberately, as it were, re-naming his species is a very remarkable one. I do not see any reason why a similar argument might not be used as against other authors whom Dr. Harris ignores. I believe that Dr. Harris would have been only too glad to have availed himself of Hübner's accurate determinations had he known of their existence. I conclude, therefore, that Dr. Morris is perfectly right in his remarks in a foot-note to *I. inclusa*, in Flint's edition, and that Dr. Hagen is wrong. It takes time to prepare and issue a volume of copper-plates, while a brief description can be written and printed very quickly. It is true that Dr. Hagen endeavours to throw doubts upon this decision, but equally so, that he does so from prejudice against Hübner, as I shall show. Besides these two illustrated works, Hübner issued a sheet called the "Tentamen," probably in 1803, in which he simply proposed a number of new genera for European moths, giving no description, and merely citing the type by its scientific name. He then commenced the issue of his "Verzeichniss," in 1816; in this, he endeavored to arrange the Lepidoptera of the whole world in a large number of genera, the diagnoses of which are very brief and usually unsatisfactory. To understand the importance of these works, we must go back a little.

Linnaeus arranged the whole Lepidoptera under the "Genera" *Papilio*, *Sphinx*, *Bombyx*, *Noctua*, *Geometra*, *Pyralis*, *Tortrix*, *Tinea*; which now are considered as types of "families." Fabricius increased these genera by several, such as *Zygæna* and *Hesperia*; Latreille added, *Callimorpha*, etc., but the modern idea of a genus is anticipated first by Hübner. Unfortunately Hübner took no pains to give structural features, or to properly limit his genera. Colour and pattern were used by him in his scant definitions, instead of real form of parts, and while the number of his genera is excessive, the species are quite often unhappily associated. On the other hand, Hübner in important points showed himself ahead of his time. He correctly divided the *Hesperidae* into two groups. He is the first to associate the genera *Bombycia* and *Thyatira*, and after all is said and done, his arrangement of the whole sub-order shows that he must have made continuous studies to suggest so much that is permanently valuable. In Europe, the successors of Ochsenheimer and the Viennese school of Lepidopterists which had flourished since the "Wiener Verzeichniss," neglected Hübner and misapplied his terms. From this neglect arose of late years the attempt to restore Hübner's terms to their undoubted right, and this attempt met with a somewhat violent opposition in certain quarters. It is an easy task to overhaul and criticise these works of Hübner, and the style in which it was performed by Mr. W. H. Edwards in the pages of the *Canadian Entomologist*, leaves little to be desired in the way of abuse. But unwilling to stand alone in the matter, Mr. Edwards enlisted the aid of Dr. Hagen, and the plan was brought into execution by which Hübner should be ruled out altogether. It was to show that Ochsenheimer, Hübner's contemporary, and a leading authority, simply ignored Hübner's genera, and that Hübner himself attached no importance to his Tentamen. To do this, Dr. Hagen translated a sentence out of Ochsenheimer, and by ingeniously inserting a full stop, changed its meaning. "This sheet (the Tentamen) I saw long after the printing of my third volume was done," writes Ochsenheimer, and here, Mr. Edwards following Dr. Hagen, inserts the stop. But Ochsenheimer in reality goes on *without any stop*; "therefore I could not earlier have adopted anything out of it." And Ochsenheimer *did* adopt Hübner's genera out of the Tentamen in his fourth volume, such as *Cosmia*, *Xylena*, *Agrotis*, *Graphiphora*, etc., and where he cites them in the synonymy, as *Heliophila*, we have no ground for the procedure, since Ochsenheimer's own genera have also no diagnoses. Dr. Hagen additionally gives us 1816 instead of 1810 for the date of Ochsenheimer's third volume, apparently to spin out the time since the issue of the Tentamen; the exact date of the latter being in some doubt. From 1802 to 1806, various dates have been given to it, while probably it was printed in 1803. In Europe, of late years, Hübner's genera, such as could be used, have been adopted, and while I am of opinion that no changes should be lightly made in our existing nomenclature on account of a generic title proposed by Hübner and that a large number of Hübner's generic titles must be dropped

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for good, I believe it to be impossible to reject Hübner altogether, as it would necessitate too much fresh naming and work. It is evident that we are practically near the solution of the whole question, and that having taken out of Hübner what we can fairly use, we shall drop him and further quarrelling on the subject. The controversy has been, however, an interesting one, as illustrating literary vehemence.

After Hübner, the work of Kirby on Canadian insects in the Fauna Amer. Borealis, merits our attention. This author describes and figures the rare *Smerinthus Cerisyi* and *Alypia MacCullochii* (Fig. 29). I have not been able, however, to identify his *Sesia ruficaudis*; the supposition that it is *Hemaris uniformis* is contradicted by the description. Other North American moths described by Kirby and not since positively made out are *Deilephila intermedia* and the species of *Plusia*, while his *Arctia parthenice* has been identified as a variety of the common *Arctia virgo*, a species which Kirby does not seem to have known as he does not allude to it. Kirby's descriptions have been reprinted in the *Canadian Entomologist*, and we can now pass briefly in review



FIG. 29.

the works written and published in America itself upon our butterflies and moths up to the year 1858, the first hundred years after Linnæus.

The first author whose works have left an indelible impression upon the science of entomology in America is Dr. Harris, who resided for the time in Cambridge and was librarian of Harvard University. An original copy of his published writings is before me, with notes in his hand, and some comments by the late Dr. Fitch, from whose library the book came into my possession. The importance of Dr. Harris's work is not measured only by the amount of information on North American entomology gathered by him; it is the general useful direction which his enquiries take and which is to be the model of future work in America in the same field. Dr. Harris is the first of the State Entomologists, a body of scientific men who are naturally to accomplish much practical good in a country whose wealth so largely depends upon agriculture. The first part of Dr. Harris's "Report on the habits of insects injurious to vegetation in Massachusetts" was submitted to the Senate and House of Representatives of the State by Edward Everett, on the 19th of April, 1838. Previous to this, some lists had appeared but no description of species. His "Descriptive Catalogue of the North American Insects belonging to the Linnæan Genus Sphinx in the cabinet of Thaddeus William Harris, M.D.," appeared in the pages of Silliman's Journal, No. 2, Vol. 36, in the ensuing year (1839.) There is, then, no doubt that the plates of Hübner mentioned above have priority over the descriptions of Dr. Harris, who can very well afford to lose the few species considering the greater importance of his total work, as such a course, from the conscientious regard for priority displayed in his writings, would have also pleased him best. I have elsewhere written at some length upon Dr. Harris's Report. It has become classical upon its subject, going over the whole range of our noxious insects as then known. I need refer here only to that portion which treats of the Lepidoptera, or butterflies and moths.

Under the heading of "Insects injurious to Vegetation" we might arrange nearly the whole of our Lepidoptera, since the larvæ almost all feed upon plants. The exceptions to this rule are the bee moths, probably imported species of *Galeria* which feed upon wax, and two species of *Phycidae*, *Euzephora coccidivora* and *E. pallida*, described by Prof. Comstock, and which devour plant lice instead of plants, as caterpillars. There is also some evidence that the Tineid, *Euclementia bassettella*, is also predaceous in its habits. A good many species of moths, however, become of great economic importance from their feeding upon cultivated plants, and it is these primarily that have become the subject of investigation on the part of the State and general Government, and which work in the United States has arrived at dimensions unknown in Europe. It is a known fact in Europe that the efforts at keeping down the numbers of certain noxious species of Lepidoptera have been, in certain localities, effective. For instance, the White Tree Butterfly, *Aporia crataegi*, no longer appears in such swarms as formerly, and this is attributable to the systematic way in which the nests of the caterpillar have been broken up and destroyed in France and Germany. On the other hand, swarms of the Cabbage Butterfly and several sorts of injurious moths still recur at irregular intervals. This swarming of

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a noxious species seems often to depend upon some interference with the usual natural checks in the shape of parasites, or to the prevalence of suitable weather to the development and increase of the broods. When we cultivate cereals or any plant of economic value we, in effect, afford an abundance of good and appropriate food for the insects which habitually live upon it. It will be recollected that the maple and other shade trees in Brooklyn and New York used to be completely defoliated by the middle of summer by the common Brown Drop or Measuring Worm, *Eudalimia subsignaria*. The European sparrow rid the cities of this nuisance completely; it cleaned them all out. Recent examinations of the stomachs of this bird in Europe prove that, although it eats also grain or farinaceous food, over fifty per cent. of its food is animal, chiefly the larvæ of insects. But other writers make, from experiment, the percentage less, and I do not feel certain that the introduction of the sparrow is defensible on the ground that it is a strictly useful bird on all occasions. But few things, animals or man himself, are always a practical success and on all occasions. Except as against this Brown Measuring Worm New York could have got along without the help of the sparrows.

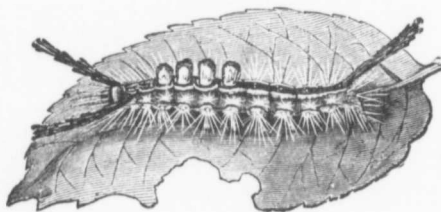


FIG. 30.



FIG. 31.

A common pest in the east is the hairy larva (Fig. 30) of the Vapourer Moth, *Orgyia leucostigma* (Fig. 31), which, owing, perhaps, to its long hair-pencils used in making its cocoon, is less readily eaten by sparrows or other birds.

The true remedy for the Vapourer is the sweeping down of the egg masses laid outside of the cocoon by the wingless female. (Fig. 32 represents *a*, the wingless female and the mass of eggs laid on the outside of the cocoon; *b*, a young larva suspended by its silken thread; *c*, the female chrysalis, and *d* that of the male.) With industry and care there need never be any trouble from this insect, and a small sum of money would rid all cities in a short time of this pest, were the cleaning of the city

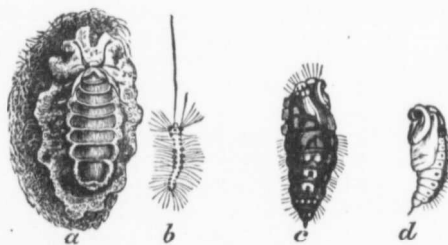


FIG. 32.

undertaken at the proper moment. Other species occasionally increase largely in certain seasons from unknown causes. On Mount Desert one season I saw myriads of the Pretty Pine Spanner, *Cleora pulchra*, which is not usually so plentiful. The several species of pine, native and imported, become infested by the Pine Pest, *Pinipestis zimmermani*, a small pyralid, the larva of which seems to have but one annual brood, feeding beneath the bark, causing the gum to exude and deforming the tree by swellings. This insect is widely spread over the Middle States. Now it is evident that we can only diminish effectively the numbers and the damage caused by

these and other sorts of insects when their whole history is completely known. Then and then only, inasmuch as each species has its peculiar habits and ways of living, can we propose rational means for their abatement. This is perfectly clear, as also that experiments as to the means to be employed for the abatement of any one species are a perfectly legitimate matter for Governmental expense. Still, the fact remains that we can do but little, practically, to check the ravages of certain of our insect enemies. Many appear suddenly and again disappear before remedies can be efficiently employed. For the abating of many kinds we can only wait the action of their natural enemies. My experience leads me to this one conclusion, that *mechanical means for the abatement of any insect injurious to vegetation are, as a rule and with some proper exceptions, preferable to the employment of poisons.* Before the *American Association for the Advancement of Science*, in 1879, I read a paper showing that the damages resulting from the employment of Paris Green and arsenical poisons outweighed the benefits, pecuniarily in the death of stock, while accidents to persons had become not unfrequent from its unlicensed use. This protest has, I believe, borne some fruit. I am also of opinion that more good would be brought about by including an elementary course of entomology, teaching the life history of our commoner and destructive insects, in the Public Schools, especially throughout the agricultural districts, than by the present system of publishing reports which do not sufficiently reach the farmers who pay for them. It should be the duty of the State Entomologists to lecture in the Public Schools. If an easy text book were published, and an effort made to have it introduced, good results would be soon obtained. Farmers' boys would learn to destroy the nests of the tent caterpillar rather than of the robin. The protection of birds and, in fact, all natural enemies of our predaceous insects is a main feature of the whole matter.

I may here refer to the Cotton Worm, *Aletia argillacea*. This species belongs to the class of migratory pests. I have shown that it was probably introduced during the last century from the West Indian Islands where cotton was cultivated. That, in common with many other moths, it has a seasonal migration from south to north, and that its foothold and multiplication on the soil of the United States was dependent on the introduction and cultivation of the cotton plant. I was the first to show its full habits: that it hibernated as a moth and that there was a geographical, climatic limit to its successful hibernation. In other words, the moth, even within the cotton belt where I made my first studies, did not survive the winter to lay fresh eggs on the young cotton of the ensuing year, and that the new worms came from a fresh immigration of the moth from points farther south.

I can see no reason for any change in my general views on the whole matter of the Cotton Worm. I could not, as a private individual, journey over the whole South and find out the line of successful hibernation. That such a line exists somewhere is the whole gist of my paper. Before I read it, it was not known that *Aletia* hibernated as a moth, it was not known that it did not breed everywhere the ensuing year from eggs laid by the progeny of the year before. The main question, so far as I can see, still remains where I left it.

The white Maple Spanner, *Eudalimia subsignaria* of Hübner, used to be so common in Brooklyn and New York, from 1855 until well into the sixties, that the shade trees of all kinds except the Ailanthus, became completely defoliated. I remember especially one poor tree at the old Nassau Street post office in New York which became as bare as in winter by the middle of June, and struggled with a stunted after-growth of leaves in July. Everywhere the brown Measuring Worms used to hang down and cover the sidewalks in New York and suburbs to the great discomfort of the passers by. I have seen ladies come into the house with as many as a dozen of the worms on their skirts or looping over their dresses. The advent of the English sparrow changed all this; the naked brown larvæ of the Maple Spanner disappeared before them and gradually all the other naked larvæ became scarce. Such were for instance the larvæ of *Eudryas*, *Alypia*, *Thyreus Abbottii*, *Deidamia inscripta*, *Everyx myron*, *Chamyris cerinthia*, etc., all of which I used to find abundant in the small gardens in Brooklyn, chiefly feeding on the grapevines. The larvæ of the Vapourer, *Orgyia leucostigma*, being hairy and less palatable to the sparrows, however, remained and multiplied; becoming, in Philadelphia, as great

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It is, therefore the study of entomology a great development in agricultural countries particularly the case of importance, and the who described so a point of time. So most interesting in named by him, if "Cotton Worm M. Harris's report on moths in New England speaking, in infancy of our life 1840, things were born and the study strength of the In branches. Louis 2 siasm consequent u Harris prepared a Lake Superior regi rare one. In his r the name of *Argen* in the Katskill M. *Hepialus* was colle noting the differen distinct species wh more pinkish or sal described in the tl delphia, p. 73, pl.

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a nuisance as the Maple Spanner had been, which with the assistance of the sparrow it had replaced.

It is, therefore, evident from the foregoing digression upon injurious insects, that the study of entomology has a practical side, and that this practical side has attained a great development in the United States and Canada, from the fact that these are mainly agricultural countries, whose wealth is in the products of their soil, as in Europe is particularly the case with France. Therefore it is that Dr. Harris's Report is of such importance, and that it made much more impression than the writings of Thomas Say, who described so many more species and whose American Entomology preceded it in point of time. Say described but very few Lepidoptera, but these few are among our most interesting insects. *Smerinthus geminatus*, the twin-eyed hawk, is the only moth named by him, if we except that in a letter, posthumously published, he described the "Cotton Worm Moth" under the specific title of *Xylina*. With the publication of Dr. Harris's report and other papers, commenced the active study of our butterflies and moths in New England and the North. Abbot's observations had been made, comparatively speaking, in a wilderness, and were, besides, published in Europe, where, in the infancy of our literature, works on North America would naturally be printed. But, in 1840, things were very different. An American literature was already born and well born and the study of Natural History, which I have in another work shown to be the strength of the Indo-Germanic race, had already eminent students with us in its several branches. Louis Agassiz had come to live in Cambridge, Massachusetts, and the enthusiasm consequent upon his lectures was soon to bear an abundant harvest of results. Dr. Harris prepared a report on the insects collected by Agassiz in his memorable trip to the Lake Superior region, and the book in which it found its place has now become a very rare one. In his report Dr. Harris had described an Eastern species of *Hepialus* under the name of *Argenteomaculatus*, a species of which I have examined specimens collected in the Catskill Mountains by Mr. Meade. During this Lake Superior trip, a species of *Hepialus* was collected which Dr. Harris figures and identifies with the Eastern, though noting the difference in color and markings. I believe this to be the first notice of a distinct species which I also have received from the Lake Superior region, the wings more pinkish or salmon color, the spots smaller, the whole insect larger, and which I have described in the third volume of the proceedings of the Entomological Society of Philadelphia, p. 73, pl. I, fig. 6, as *H. quadriguttatus*.

Not only, then, is it the matter, it is also the manner of Dr. Harris's Report, which makes it still a readable book, although so much that it contains is superseded by better and fuller information. His excellent English, staid, unflippant style, absence of self-assertion and spirit of cultivated observation constitute the principal charms of the Report and redeem it from the dryness which such books must have for the reader. His memory will always make Cambridge interesting ground for the student, even when associations of this kind with the past are becoming laxer and a very different style is employed in entomological reports. Dr. Harris was more of a general entomologist than a specialist, and his work in the different suborders of insects is everywhere of the same character and bears much the same value. In his philosophy he seems to have held to the tradition of Kirby and Spence. In this connection it is worth while, if no more than as a reminder of views once prevailing, to give his reasons for the study of insects: "Surely insects, the most despised of God's creation, are not unworthy our study, since they are the object of His care and subjects of a special providence." He has a kindly courtesy for the opinions of others. In recording a contradictory statement by Miss Morris as to the habits of the Hessian fly, he says: "If, therefore, the observations of Miss Morris are found to be equally correct, they will serve to show, still more than the foregoing history, how variable and extraordinary is the economy of this insect," etc. One contrasts this involuntarily with language we sometimes see used under similar circumstances. Such adjectives as "erroneous," "incorrect," "unreliable," "vicious," etc., are foreign to Dr. Harris and his report is the gainer from this fact. I have passed some happy hours wandering beneath the Cambridge elms and conjuring up the kindly figure of this entomologist of an olden time.

The example of the State of Massachusetts was followed by New York, and Dr. Asa

Fitch shortly after commenced the publication of yearly reports on injurious insects. So far as the butterflies and moths are concerned, these reports are much less interesting to the student than Dr. Harris's; although the descriptions of the species are longer, they are also clumsier, and the literary resources of Dr. Harris in Cambridge and Boston were probably wanting to Dr. Fitch. In these New York reports we have the first descriptions of *Prionoxystus querciperda*, *Tolype laricis* and *Rhododipsa volupia*. The species of *Nolaphana* are described as *Tortricidæ* and Hübner's *Pangrapta decoralis* figures as *Hypena elegantalis*. There is everywhere great pains taken to be exact and explicit, and so far as many noxious species are concerned much valuable observation is brought together. In making an index to these reports Dr. Fitch's successor, Prof. James A. Lintner, has performed an acceptable work.

With the year 1857, the late Dr. Brackenridge Clemens commenced the publication of descriptions of North American moths. His synopsis of the Sphingidæ (1858) is characterized by great care in describing the species and genera, but the main defect of the work is the absence of independent literary research, the synonymy being taken from the British Museum lists of Mr. Walker. Dr. Clemens describes for the first time the rare *Sphinx luscitiosa*, the genera *Deidamia* and *Ellema*, and includes the West Indian forms, some of which have been more recently found in South Florida. A "Synonymical Catalogue of the Sphingidæ" was published in 1865 by the late Coleman T. Robinson and myself, in which *Hemaris gracilis*, *Euproserpinus phaton* and the genera *Cressonia* and *Diludia* were described, the literature of the group being thoroughly gone over since 1758, and henceforward the nomenclature of this family at least, takes on a more permanent shape. It is one hundred years from Linnæus to Dr. Clemens, but in North America, in 1858, there were but very few species of moths then named in collections either public or private. Commencing to publish my own studies with the beginning of the year 1862, I can say truthfully that there were then probably not one hundred species named and determined in any collection. The principal difficulty lay in ascertaining what had been described in Europe. For this purpose Mr. Robinson and I made one trip to England and France, and afterwards another was made by myself. The results of the examinations of Mr. Walker's and M. Guenee's types were published and material was determined by us from all parts of the country, in collections both public and private. There are now (1888) probably more than five thousand species of moths described from North America, and this result is due to the large and increasing number of students, and the facilities offered by serial publications, the most reliable of which has been the *Canadian Entomologist*, which has survived many similar undertakings. Each family of moths has enjoyed the attention of one prominent specialist, thus Dr. Packard has studied the Spanners, *Geometridæ*; Mr. Hy. Edwards the Clearwings, *Sesiidæ*; Mr. R. H. Stretch the Spinners, *Bombycidæ*; Prof. C. H. Fernald the Leaf Rollers, *Tortricidæ*; my own studies having been principally on the Owlet Moths, *Noctuidæ*; the Sparklers, *Pyralidæ*, and the Hawk Moths, *Sphingidæ*.

Very soon we shall know all about our moths and popularly written works will supersede the stiff and formal descriptive sources for our information which now exists. May we all be kindly remembered and our faults forgiven by the coming generation, who will catch our species and discuss our, no doubt, often defective views based upon the scantier information now at our disposal.

Of some of my contemporaries I confess I would like to say a word here, but I may not. I would like to recall the long ago when Mr. Saunders, with his kind and thoughtful and then youthful face, came to see me in New York; when Packard, on his way to "the front" during the war, called upon me in Brooklyn; when Mr. Tepper and Mr. Graef before that, collected and discussed these "little beauties" with me. And then I remember Mr. Calverley, who was very old and very good to me, and Mr. Harvey J. Rich, who died so young. In Brooklyn there are now a number of new writers, among whom my new friend, the Rev. Mr. Hulst, is working steadily and cheerfully along. But now I must think of my good friend Coleman T. Robinson, who was killed by being thrown from his carriage. An accident, equally deplorable, deprived us of Mr. Walsh. I remind me also well of Mr. Angus, of West Farms, a tall Scotchman with curious, white and black in bunches, parti-colored hair, very intelligent, kindly but

reserved. I wonder seems ages and ages ago to moralize. My Illinois, the father of an old doctor's letter at least about twenty lived. He really little entomologic for hours together still and all the time happy, and that is

The story of contributed in an many should have brief night, come home. He came in Philadelphia, Practical Entomology before the large species at our disposal. When I was in London me most happy to learn of him; ticular subject! with, I feel sure is really no necessity killed off. If, lived in a decent manner

In our Annual I have given some in checking the names up the insects in "The Fall Web- enemies and give of course quote entomologists, both in the best information

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reserved. I wonder how long ago it is since I first met Mr. Lintner, or Dr. Morris? It seems ages and ages. And Dr. Bailey is dead and J. D. Putnam. Well, well, 'tis no use to moralize. My boyhood's friend I will remember here. It was old Dr. Kennicott, of Illinois, the father of that brave and hardworking naturalist, Robert A. Kennicott. The old doctor's letters to me I treasure still. I never saw him. He wrote to me regularly, at least about twice a month, for several years. He was to me the best man that ever lived. He really taught me, although he never gave me a lesson. I used to sit in my little entomological room, a boy of fifteen, with his photograph on the table before me, for hours together, reading his letters. I have never forgotten him. He lives with me still and all the time. He was a man that must have made a great many people very happy, and that is to be the truest friend and the best man of us all.

The story of the growth of our literature is the individual story of each one who has contributed in any way to its augmentation. Having worked so long it is natural that many should have come to me. Very few stayed away. Even Mr. Strecker, for one brief night, consulted me and believed. He fell by the wayside, though, before he got home. He came, with his boxes, to meet me in Philadelphia, I think, early in 1873. In Philadelphia, Cresson was the leading spirit and founded the little sheet "The Practical Entomologist," which I edited for the first few numbers. Those were the days before the large "appropriations" of latter years. We took the field against the noxious species at our own expense. I am also in the first of Prof. Riley's Missouri reports. When I was in Buffalo many visited me; but, of all, it was Prof. Fernald who brought me most happiness. When he came to be my scholar, I knew I should quickly come to learn of him; and now he is teaching me a lot about the *Sphingide*, my own particular subject! As I think of the many lepidopterists I have met and corresponded with, I feel sure that the future of the science with us is beyond question and that there is really no necessity for my putting pen to paper again. I do not intend, however, to be killed off. If, like the Prince of Bulgaria, I must go, I will go with a voluntary air and in a decent manner, not be hustled out of my dominions by a conspiracy.

REMEDIES FOR NOXIOUS INSECTS.

BY REV. C. J. S. BETHUNE, PORT HOPE.

In our Annual Reports for the last two years (1886, pages 55-64; 1887, pages 51-59) I have given some account of the remedies that have been found most practically useful in checking the attacks of noxious insects upon various plants and crops. I have taken up the insects in the alphabetical order of their common names, and left off last year with "The Fall Web-worm." I now propose to go on with the list of our commonest insect enemies and give the remedies that have proved most effective, and in doing this I shall of course quote very freely from the experience of the most skilled practical entomologists, both in the United States and Canada, in order to furnish our readers with the best information that can be obtained on the subject. The next insect on our list is

THE GOOSEBERRY FRUIT-WORM (*Dakruma convolutella*, Hubn.).

Besides the caterpillars and saw-fly worms which destroy the foliage of the gooseberry and often strip the branches entirely of their leaves, and which have already been referred to under the heading of Currant insects, there is another insect trouble which frequently causes the gardener much annoyance. When the fruit is partially grown, many of the berries are often observed to have become discoloured; some turn to a dull whitish colour, and some shrivel up, while others, more advanced, seem to ripen prematurely; in either case they soon drop from the branches to the ground. On inspection it is found that nearly every berry contains a small, pale worm, which is engaged in devouring the pulp of the fruit. This worm



FIG. 33.

is the larva of a little pale gray moth (Fig. 33), which appears about the end of April

or early in May, and lays its eggs on the young gooseberries soon after they are formed. The eggs soon hatch and the tiny caterpillars burrow into the fruit, where they remain in safe concealment. When they have grown considerably they fasten two or more berries together with silken threads, sometimes biting off the stems in order to bring them more easily into the required position, and here they live securely with plenty of food convenient. This tying of the fruit together is more frequently done in the case of the wild gooseberry and the currant, which it also attacks, and whose berries are not large enough to contain the worm. When fully grown the caterpillar lowers itself to the earth by a silken thread, and there spins its cocoon (Fig. 33) among leaves or rubbish on the surface of the ground. In this state it lives all winter, the moth appearing, as already stated, the following spring.

The most obvious remedies for this pest are (1) picking off by hand all prematurely ripened or discoloured fruit and burning or otherwise destroying them. As, however, the worms are very active and quickly make their escape to the ground when disturbed, a close watch should be kept in order to trample under foot any that may get away. (2) Clearing up and burning all fallen leaves and other rubbish beneath the infested bushes, after the fruit season is over, and in this way destroying the insect in its chrysalis state. It is also recommended to dust the bushes freely with air-slacked lime early in the spring, renewing the application from time to time as may be necessary, the object being to prevent the moth from laying her eggs on the young fruit.

THE GOOSEBERRY MIDGE (*Cecidomyia grossularia*, Fitch)

Is another enemy to the fruit of the gooseberry. Its presence may be ascertained, as in the case of the previous insect, by the premature ripening or discoloration of the berries. It is a very tiny maggot, of a bright yellow colour and closely resembling the wheat-midge. It lives within the fruit both in its larval and pupal states, and the minute two-winged fly comes out about the end of July. How the species is perpetuated from one season to another is not yet fully known, but it is supposed that there is another brood in some later fruit or other suitable substance, and that in this way the insect is carried over the winter.

The same remedies may be employed as those given for the fruit-worm, care being taken to destroy the fallen gooseberries early in July, before the fly has had time to complete its transformations.

THE GRAPE-VINE LEAF-HOPPER (*Erythroneura vitis*, Harris).

This little insect, popularly called "The Thrips," often proves very injurious to the vine. The thin-leaved varieties, such as the Clinton and Delaware, suffer much more severely from it than those with thick leathery foliage. We have seen a small vineyard of Clinton grapes almost entirely defoliated before the end of the summer by the attacks of this tiny enemy, with the result, of course, that the fruit failed to mature and became simply worthless. The insect, of which there are several species known, belongs to the true bugs (*Hemiptera*), and like the rest of its order, lives by sucking the juices of plants.

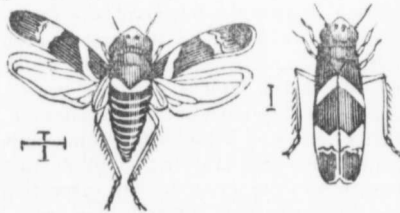


FIG. 34.

perfect state, hibernating under dead leaves or other rubbish, the survivors becoming active

The accompanying illustration (Fig. 34) represents the perfect insect, greatly magnified; the natural size is shown by the short lines to the left of each figure, one representing the insect with wings expanded ready for flight, the other with the wings closed. The different species vary in colour and markings, but the one shown here is dusky and red, with pale stripes.

"These insects—to quote Saunders's *Insects Injurious to Fruit*—pass the winter in the perfect state, hibernating under dead leaves or other rubbish, the survivors becoming active

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in spring, when they deposit their eggs on the young leaves of the vine. The larvæ are hatched during the month of June, and resemble the perfect insect, except in size and in being destitute of wings. During their growth they shed their skins, which are nearly white, several times, and although exceedingly delicate and gossamer-like, the empty skins remain for some time attached to the leaves. The insects feed together on the under side of the leaves, and are very quick in their movements, hopping briskly about by means of the hind legs, which are especially fitted for this purpose. They have a peculiar habit of running sideways, and when they see that they are observed on one side of a leaf they will often dodge quickly around to the other. They are furnished with a sharp beak or proboscis, with which they puncture the skin of the leaf, and through which they suck up the sap, the exhaustion of the sap producing on the upper surface yellowish or brownish spots. At first these spots are small and do not attract much attention, but as the insects increase in size the discoloured spots become larger, until the whole leaf is involved, when, changing to a yellowish cast, it appears as if scorched, and often drops from the vine. Occasionally the vines become so far defoliated that the fruit fails to ripen."

"As the leaf-hopper enters the second stage of its existence, corresponding to the chrysalis state in other insects, diminutive wings appear, which gradually grow until fully matured, the insect meanwhile becoming increasingly active. With the full growth of the wings it acquires such powers of flight that it readily flies from vine to vine, and thus spreads itself in all directions. It continues its mischievous work until late in the season, when it seeks shelter for the winter."

A species of this insect also attacks the Virginia Creeper, and in a dry season, which seems most favourable for its development, we have known it to completely destroy the foliage of the creepers on a building, and render them leafless before the close of summer. When disturbed the insects hopped in myriads from leaf to leaf, making a sound like the pattering of fine rain.

Remedies.—When these insects attack the vines in a glass grapery, it is not very difficult to deal successfully with them. First, carefully close the ventilators and any other openings in the house, and then fumigate thoroughly by burning Persian Insect Powder (*Pyrethrum*) beneath the vines. This has been found by experiment to be perfectly effective. Tobacco may be used instead of insect powder, but the latter is not reliable. After the operation all fallen leaves, etc., should be carefully removed and burnt.

Out-of-doors it is by no means so easy to deal with this pest. Fumigation is almost impossible, as the smoke cannot very well be kept long enough about the vines to destroy the insect. On a calm still day, however, it would be worth trying. It should be done several times at intervals of a few days, and if possible, before the insects have obtained their wings and are able to fly away from the smoke. Syringing with strong soap-suds, tobacco-water, hellebore mixed in water, etc., and dusting with lime or powdered sulphur, have all been recommended, and are remedies worth trying. In all cases it is important to keep the ground clean beneath the vines and leave no rubbish for the protection of the hibernating insects.

Mr. Fletcher, in his Report for last year, says that the remedy "which gives the most promise of success is a weak kerosene emulsion in the proportion of one of kerosene to thirty of water, to be applied at the time when the young bugs have first hatched. Mr. John Lowe, the Secretary of the Department of Agriculture at Ottawa, tells me that he has never failed to drive these insects off his grape-vines by simply applying sulphur, which, when liberally applied to the vines, gives off on warm days a perceptible odour of sulphurous acid gas which keeps the insects away."

Dr. Lintner, in his second Report as State Entomologist for New York, mentions that the vapour from tobacco juice has been very successfully employed in France as a remedy for the grape-vine "thrips" and other small insects that infest plant-houses. He quotes the experience of one who has tested it, and who says: "Ever since I adopted it, it has been absolutely impossible to find a thrips in my houses; and other insects have likewise disappeared." The mode of employing the remedy is thus described:—

"Every week, whether there are insects or not, I have a number of braziers containing burning charcoal distributed through my houses. On each brazier is placed an old sauce-pan containing about a pint of tobacco juice of about the strength of 14°. This is quickly vaporized, and the atmosphere of the house is saturated with the nicotine-laden vapour, which becomes condensed on everything with which it comes in contact—leaves, bulbs, flowers, shelves, etc. When the contents of the sauce-pans are reduced to the consistency of a thick syrup, about a pint of water is added to each, and the vaporization goes on as before. I consider a pint of tobacco juice sufficient for a house of about 2,000 cubic feet. The smell is not so unpleasant as that from fumigation, and the tobacco juice can be used more conveniently than the leaves. Plants, no matter of what kind, do not suffer in the least, and the most delicate flowers are not in the slightest degree affected, but continue in bloom for their full period, without any alteration in their appearance. When the operation is completed, if the tongue be applied to a leaf, one can easily understand what has taken place from its very perceptible taste of tobacco. The process requires to be repeated in proportion to the extent to which a house is infested. It is not to be imagined that these troublesome guests are to be quite got rid of by a single operation. A new brood may be hatched on the following day, or some may not have been reached on the first day, so that the vaporization should be frequently carried on till the insects have entirely disappeared, and after that it should be repeated every week in order to prevent a fresh invasion."

In France, Dr. Lintner adds, tobacco juice of the strength required can be purchased at the tobacco factories for about fifteen cents a quart, so that the expense is very trifling. Where the juice cannot be readily bought, it may be prepared by boiling coarse tobacco leaves and stems, till the decoction is of the required strength.

THE HOP APHIS, (*Phorodon humuli*, Schrank.)

While the hop, like most other cultivated plants, is liable to the attacks of a great many insects, it is in this country specially injured by two very different creatures, the Hop Aphis or Plant-louse, and the Hop Snout-moth. The latter is referred to in another part of this Report by Mr. Fyles. Regarding the former, a most important point in its life-history has at last been cleared up. Till very recently it was not known exactly how or where the insect passed the winter, and consequently it was not possible to be quite sure what preventive measures were the best to adopt. Four years ago, Miss Ormerod, Consulting Entomologist to the Royal Agricultural Society of England, published in her annual Report on Injurious Insects, an account of her observations of the Hop Aphis, and stated the conclusions at which she had arrived. These are so important that I quote her own words: "(1) The first attack of Aphis to the hop begins in spring from *wingless females (depositing living young) which come up from the Hop-hills.* (2) The great attack, which usually occurs in the form of 'Fly' about the end of May, *comes on the wing from Damson and Sloe, as well as from Hop, and the Hop Aphis and the Damson-hop Aphis are very slight varieties of one species, and so similar in habits as regards injury to hop that for all practical purposes they may be considered one.*"

These observations, while they confirmed what had been stated by some few entomologists at different times, threw a flood of new light upon the life-history of the Hop-Aphis, and led to further investigations by other competent observers. In the November, 1888, number of "Insect Life," Dr. C. V. Riley, United States Entomologist, publishes a paper on this subject, in which he announces that "We have been able to say for the first time the past year, that we now know positively the full life-history" of the Hop Plant-louse, and states that the questions as to its migration from the Damson to the Hop, and its winter resting place, have now "been fully and thoroughly settled."

The following is his summary of the life-history of this insect: "Hibernating at the present season of the year (March), the little glossy, black, ovoid eggs of the species are found attached to the terminal twigs, and especially in the more or less protected

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crevices around the buds, of different varieties and species of *Prunus*, both wild and cultivated. From this winter-egg there hatches a stem-mother (Fig. 35), which is characterized by being somewhat stouter, with shorter legs and honey tubes than in the individuals of any other generation."

"Three parthenogenetic generations are produced upon *Prunus*, the third becoming winged (Fig. 36). This last is called the *Pseudogyna* or the migrant, and it instinctively flies to the hop-plant, which is entirely free from attack during the development of the three generations upon Plum. A number of parthenogenetic generations are produced upon the Hop, until in autumn, and particularly during the month of September, winged females are again produced. This is the *pupifera* or return migrant, and she instinctively returns to the Plum. Here she at once settles and in the course of a few days, according as the weather permits, produces some three or more young. These are destined never to become winged and are true sexual females (Fig. 37). Somewhat later, on the Hop, the true winged male (Fig. 38), and the only male of the whole series is developed, and these males also congregate upon the Plum, on the leaves of which toward the end of



FIG. 35.

Stem-mother, enlarged; head and antenna still more enlarged.

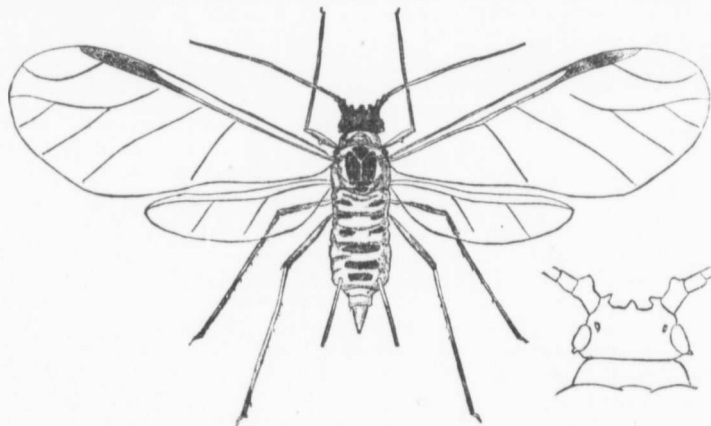


FIG. 36.

First migrant from the plum, third generation, enlarged; head at side still more enlarged.



FIG. 37.

True sexual female, enlarged.

the season they may be found pairing with the wingless females, which stock the twigs with the winter eggs (Fig. 39). Such, briefly, is the life-history. Twelve generations may be produced during the year, but there is great irregularity in the development of these generations and the return migrant from the Hop is produced at the end of the season whether from individuals of the fourth or fifth generation, or of the twelfth."

"Each parthenogenetic female is capable of producing on an average one hundred young (the stem-mother probably being more prolific), at the rate of one to six, or an average of three per day, under favourable conditions. Each generation begins to breed about the eighth day after birth, so that the issue from a single individual easily runs up, in the course of the summer, to trillions. The number of

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leaves (seven hundred hills, each with two poles and two vines) to an acre of hops, as grown in the United States, will not, on the average, much exceed a million before the period of blooming or burning; so that the issue from a single stem-mother may, under favouring circumstances, blight hundreds of acres in the course of two or three months.*

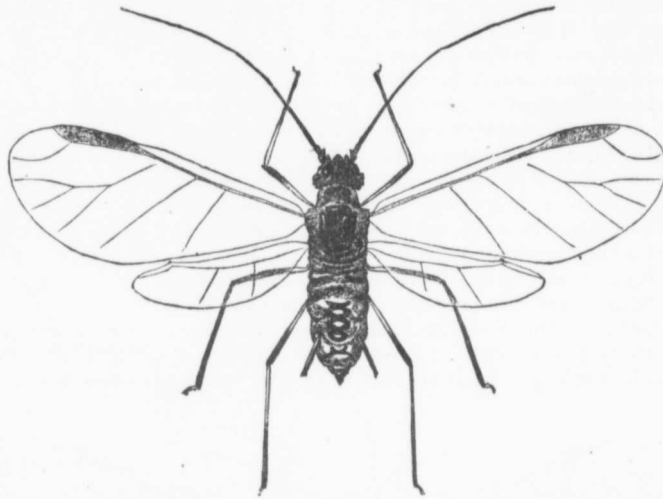


FIG. 38.

Winged male enlarged.

The foregoing account of the life-history of the Hop Aphis is so wonderful and interesting that we feel sure the readers of our reports will be glad to have it brought before them. It is also of great value, as it enables hop growers now to apply remedies and use methods of prevention that could not have been devised when the true habits of the insect were unknown.

The first and most obvious preventive measure is the destruction of the Aphis on the plum trees in early spring before they have migrated to the hop. This can be done by syringing the trees with a strong tobacco or soap wash, or more effectively still, by using a weak kerosene emulsion. Receipts for making this were given in our report for 1886, but for convenience sake we quote a simple method recommended by



FIG. 39.

Eggs and shrivelled skin of female which laid them, enlarged.

Professor A. J. Cook, of the Agricultural College of Michigan; he says: "I have found nothing so satisfactory in treating plant-lice as the kerosene and soap mixture. To make this I use one-fourth of a pound of hard soap, preferably whale-oil soap, and one quart of water. This is heated till the soap is dissolved, when one pint of kerosene oil is added, and the whole agitated till a permanent emulsion or mixture is formed. The agitation is easily secured by the use of a force pump, pumping the liquid with force into the vessel holding it. I then add water so that there shall be kerosene in the proportion of 1 to 15." This mixture has been found

* We have to thank Dr. Riley for his kindness in permitting us to use the above illustrations of the Hop-Aphis. They were originally drawn by him to illustrate his paper on the subject in "Insect Life," vol. i., pp. 133-136.

Another method, on a large scale, is the immediate neig from the insects,

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Another measure of prevention that should be adopted where hops are grown on a large scale, is the removal and destruction of all wild or cultivated plum trees in the immediate neighbourhood of the plantation. This will take away their winter refuge from the insects, and save an infinite amount of trouble.

When the Aphis has made its appearance upon the hop vines, a kerosene emulsion should be at once employed for its destruction. By careful watching and prompt treatment this pest can, no doubt, be kept within bounds, but it must be dealt with without delay, otherwise its extreme prolificness will soon fill the hop-yard with myriads, and render its destruction very laborious and difficult.

THE ONION MAGGOT (*Phorbia ceparum*, Meigen).

This imported European insect is quite common in Canada and the Eastern United States, and often proves very destructive to the onion crop. The attack is made by the larva, or maggot, of a little two-winged fly, which eats into the bulb of the onion and destroys it, partly by its own work, and partly by the decay which results from it.

The accompanying illustration (Fig 40) represents the parent fly magnified, the line below showing the natural size with outspread wings; beneath this the pupa is shown, and below it the maggot; the figure to the right exhibits the maggot devouring the interior of the onion bulb. The fly lays her eggs early in the season on the leaves of the young onion, close to the surface of the ground; from these the young maggots are soon hatched, and penetrate downwards between the leaves to the base of the bulb. Several of them are generally found together; they are yellowish white in colour, tapering from one end to the other, and destitute of legs. When not feeding they generally lie just outside the onion in a cell of wet mud, which is kept damp by the exuding juice of the injured plant; they feed for about a fortnight, and then transform in the earth into brown pupæ, of an oval shape; from these the flies emerge in a fortnight or three weeks, and at once lay their eggs for a second brood. In this case, as the leaves are now high above the bulb, the fly lays her eggs on the bulb itself, or on the ground close to it. At the close of the season, the insect remains for the winter in the pupa state, from which the winged flies come forth in early spring to begin another round of the life of the species. Such, in brief, is the life-history of the insect.

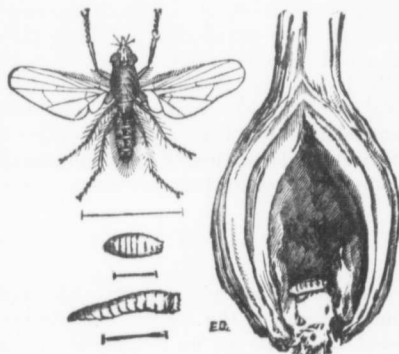


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The best method of dealing with this insect is to prevent the attack if possible. Two modes of doing this have been tried with success. The first, and most satisfactory plan, is to bury the bulb of the onion so that the fly cannot deposit its eggs upon it. This is done by earthing up the plants as is customary with potatoes and corn. The flies must deposit their eggs somewhere, and prefer to do so on the bulb itself, or very close to it; if this is well covered up with earth the eggs are laid higher up on the plant, or on the ground, and the young larvae, when hatched, are unable to get to their proper feeding place, and consequently perish without doing any injury. Miss Ormerod recommends growing onions in the garden in a trench, prepared in the same way as for celery, and gradually drawing down the earth from the sides as the plants grow, thus keeping the bulb always covered. She found this plan entirely successful in warding off the attacks of the insect.

The second mode of prevention is to scatter about the plants some substance that will be sufficiently obnoxious to the female fly to keep her entirely away from the crop. For this purpose gas-lime has been found most effective. It should be sown broadcast over the bed about once a fortnight, but great care must be taken not to put it on too thickly, as it is extremely caustic, and would seriously injure the plants. Mr. Fletcher

Illustrations of the
in "Insect Life,"

says that a light sprinkling, just enough to colour the soil, answers the purpose. As this substance, however, can only be procured from a town where there are gas works, it may be impossible to get it in many localities. A substitute for it may be readily made in the following manner: "Take two quarts of soft soap and boil it in rain water until all is dissolved, then turn in a pint of crude carbolic acid. When required for use take one part of this mixture with fifty of water, and when mixed well together sprinkle directly upon the plants." This carbolic wash has been found entirely successful in the case of the Radish-maggot, which is very similar in its attack to the Onion-maggot. It is recommended to sprinkle the beds every week, commencing two days after the seed is sown, and before any of the young plants are up.

As a direct remedy when the onions in the kitchen garden are attacked, it is recommended to pour boiling water upon the affected bulbs; it is stated that this will kill the maggots and not injure the plants. It is certainly worth trying in a few cases to begin with, and then it may be continued, if found satisfactory.

It is an important matter, also, to remove from the beds all the onions that are attacked with as little delay as possible. They may be known at once by their leaves fading and turning yellow. It will not answer, however, to merely pull them up by the hand, as in most cases the leaves only will come away, leaving the infested bulb still in the ground, but it will be found necessary to use a spud, or trowel, or some such instrument, in order to take up the whole onion with its rotten mass full of maggots. This should at once be put into a pail, from which the creatures cannot escape, and then carefully destroyed. By so doing the next brood of flies will be materially reduced and the severity of attack diminished. One further point is not to grow onions two years in succession on the same ground, and if a bed has been infested by the maggot to turn the surface soil deeply under in the autumn and bury the pupæ deep enough to prevent, or at any rate retard, their development in the spring.

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

Most persons who cultivate the squash in their gardens have probably noticed at times several of the leaves to be strangely withered, and on investigating further have found the cause to be a number of disgusting looking bugs gathered together on the underside of the leaves. There is usually a large colony collected together, composed of individuals of all sizes from the tiny newly-hatched bug to the old winged specimen half an inch long, represented in Fig. 41.

The life-history of the insect may be briefly related, as follows:—The full-grown insects that have managed to escape the various perils to which their lives are exposed during the summer, retire into winter quarters on the approach of cold weather, and conceal themselves in various nooks and crevices. There they remain in a torpid state all winter, and come forth when warm weather returns in May. At this time of the year and also in the autumn, they may be found in all sorts of unlikely places, but as soon as the squash plant has put forth its first few leaves, the insects take shelter under them and lay their eggs for the future crop of destroyers. The female deposits her eggs in little patches on the underside of the leaves, to which they adhere, and performs the work for the most part at night. This takes place late in June, or even in July if the season is backward, but the eggs are soon hatched and there issue from them the tiny little bugs. At first these are ash-coloured, with large flattish antennæ, and without any wings, but they grow rapidly and with each moult become darker above and paler beneath; at the same time they gradually change their form from a round scale-like appearance to an oblong oval, with a triangular head. As the eggs are laid at intervals, fresh broods keep coming out all summer, and thus specimens of all ages and sizes are usually found crowded together on the same leaf. They all have an excessively disagreeable smell, which is intensified when their bodies are crushed. Like all true bugs they live by suction, each one being provided with a long slender beak or sucker, with which it punctures the leaves and draws up the sap.



FIG. 41.

The effect of a speedy withering

As the bugs and their presence their numbers burning. It is plant, and destroy only a few square large scale, than remedy may then to it a tablespoons stems and leaves (Lintner's Report) but it should be applied it this had commenced several seasons use of liquid manure when the plants not so much fell allied plants.

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Everyone noticed the amount so widespread

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The effect of a swarm of these creatures pumping away at the life fluid of the plant is the speedy withering of the leaf and the serious injury, if not destruction, of the whole plant.

As the bugs congregate together for the most part on the under side of the leaves, and their presence is indicated by the withered foliage, much may be done to diminish their numbers by the simple operation of hand-picking and crushing under foot or burning. It is well, also, to examine carefully the underside of the leaves of an affected plant, and destroy all eggs that may be found. This remedy is of easy application where only a few squash plants are grown in a garden. But if the cultivation takes place on a large scale, hand-picking of eggs and bugs becomes rather impracticable. The following remedy may then be employed: Take two quarts of powdered plaster of Paris, and add to it a tablespoonful of coal oil; sprinkle this mixture on the plants, especially on the stems and leaves nearest the root, where the attack is always made first. It is stated (Lintner's Report, ii. 29) that one application of this will generally answer for the season, but it should be repeated if the bugs return. The author of the remedy says: "I applied it this season on several thousand hills of melons, cucumbers, etc., after the bugs had commenced operations, and have not since had a vine destroyed. I have used it for several seasons with the same result. This is safer and cheaper than Paris green." The use of liquid manure and cultivation in a good rich soil is further recommended, for when the plants attain a vigorous growth, the loss of sap occasioned by these insects is not so much felt. As already indicated, they also attack the melon, cucumber and other allied plants.

THE TENT CATERPILLARS (*Clisiocampa Americana* and *Sylvatica*).

Everyone must be familiar with the webs of the Tent Caterpillars, and must have noticed the amount of mischief they do if left unchecked. They are so abundant and so widespread throughout the country that it seems advisable to mention again some of

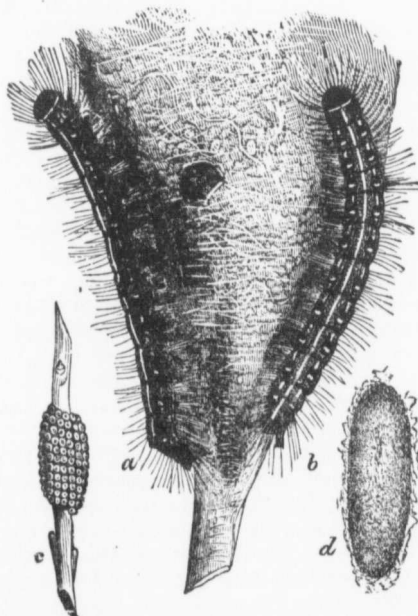


FIG. 42.

the most effective remedies for them. So few people take the trouble to interfere with the ravages of these pests that it is important to constantly draw public attention to them, even at the risk of seeming tiresome to the well-informed reader.

There are two insects familiarly known as Tent Caterpillars, from the silken webs they make upon trees. They are very similar in appearance and habits, but can always be distinguished from each other. One of them is called the Apple-tree Tent Caterpillar (*Clisiocampa Americana*, Harris), because it especially attacks apple trees. It is also very fond of the wild cherry, and will feed upon many other fruit trees. This insect is so destructive and so serious a pest that it should be fought at every stage of its existence, and the work of extermination may be begun even in the winter. When the trees are destitute of foliage, the egg-masses may be readily seen with a little practice near the end of the twigs. They are represented at *c* in the accompanying illustration, Fig. 42. By going around the orchard on a dull day in winter, when there is no sun to dazzle the eyes, the bracelet of eggs may be easily discovered, and if cut off and burnt, it will exterminate what would otherwise turn into a nest full of caterpillars in the spring.

When winter is over and the young leaves are just beginning to burst from their buds, it will be time to make another round of observation. The warmth of the spring days that has caused the buds to open and the tender leaves to expand, has also hatched the tiny eggs of this insect. The little caterpillars at first eat the gummy substance with which the egg-mass was covered for protection from wet and cold, and then they spin a fine web of white silk in a fork of the bough they are on. This forms the headquarters of the colony, and from it they make silken roads to the nearest bunch of foliage. As they grow in size, the more voracious they become, and the further they extend their rambles in search of food, until when fully grown they scatter all over the tree, or migrate to others near. The time to deal with them is evidently when they are small and collected together in their tent. Before the trees are in full leaf, the glistening white tents can be seen at once, and it will be found that the caterpillars collect together in them when the weather is inclement, and also when they are not feeding. They usually go out for their meals twice a day, in the morning and afternoon; at other times they are in their tents. Early in the morning and at night they are sure to be at home, and then is the time to destroy them. By inserting a rough stick into the middle of the web and twisting it round and round, the whole mass, caterpillars, web and all, can be brought away without difficulty, and then the worms can be crushed under foot or even between the gloved hands. If this matter is attended to early in the season, there will be no further trouble from them that year. Boys can do this work as well as anyone, and perhaps they can be taught that there is just as much fun in usefully destroying caterpillars' nests as in mischievously robbing those of the farmers' good friends, the birds. The work, however, should not be confined to the orchard and garden. These insects are even more partial to the wild cherry than to the apple, and often these trees on the borders of the woods and along the roads may be found covered with these tents. Of course, they should be as carefully destroyed as if they were on the most valuable fruit trees, for, if let alone, they will produce a crop of moths that will fly in all directions and lay their eggs even in the most vigilantly watched garden. Dr. Fitch recommended that some wild cherry trees should be planted on the borders of the orchard, in order that the moths might be attracted to lay their eggs on them in preference to the apple, as he says, it will be much easier to destroy a hundred egg-masses or tents on a single tree than if they were scattered over a hundred separate trees. Various remedies have been proposed for these caterpillars, such as coal oil, soap suds, lye, etc., but there is no method so simple and easy, and so thoroughly efficacious as destroying the tents in early spring. Where this is neglected, the results are disastrous, and orchards are sometimes seen denuded of foliage and in a pitiable state, owing to the laziness or ignorance, or both, of the owner. Such people ought to be indicted as a public nuisance, for they not only lose their own fruit, but they keep a nursery for supplying their neighbours with these destructive pests.

The next stage in the life-history of the insect is the formation of the cocoon and the change into a chrysalis. Before undergoing this transformation, the caterpillars wander away from the tree, and search for some sheltered place, such as the underside of the top boards or stringers of a fence, loose pieces of bark, etc. Here they spin each one an oval cocoon (Fig. 42, *d*) of yellowish silk, mixed up with which is some yellow dust

which looks like powder in the month of June.

The final transformation is into the moth. Fig. 43 represents a larger caterpillar across the fore-wing and the whole creature in July and may at once be seen in houses by lights at night, and in the room, here and there, when the lamp, then spiriting into the butte, is taken of destroying a future generation.

The other insect, *Clisiocampa sylvatica*, in appearance at all times, in clusters (Fig. 44) square, as it were, by comparing the tent with the top is depressed.

The caterpillars of the Apple Caterpillar differ in colour and appearance and by the transverse lines.

Very much the same as have been recorded is that the Forest Caterpillar of a tent in a fork of a tree. When gathering them with a stick

which looks like powdered sulphur. These cocoons should be looked for and destroyed in the month of June.

The final transformation of the insect is to the perfect state, that of the winged moth. Fig. 43 represents the male; the female is much similar but larger. The colour is a dull, reddish brown with paler oblique bars across the fore-wings, as shown in the figure. The body is stout and the whole creature very fluffy. They usually appear early in July and may at once be recognized, as they are attracted into our houses by lights at night, by the mad way in which they dash about the room, here and there and everywhere, singeing their wings at the lamp, then spinning on their heads on the table, and if it should be supper-time dropping into the butter dish and covering its contents with the fluff off their bodies. These idiotic performances may enable any one to identify them, and the opportunity should be taken of destroying them, both for the purpose of getting rid of a present nuisance and of a future generation.



FIG. 43.

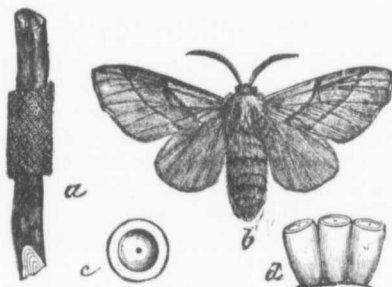


FIG. 44.

The other insect referred to at the outset is called "The Forest Tent Caterpillar," *Clisiocampa sylvatica*, Harris. It resembles the Apple-tree Tent Caterpillar very closely in appearance at all its stages, and also to some extent in its habits. The eggs are laid in clusters (Fig. 44 *a*) on the twigs of trees as in the other species, but the mass is cut square, as it were, at the ends instead of being rounded. The difference may be observed by comparing the two figures. The individual eggs are of the shape shown at Fig 44*d*; the top is depressed and circular, as at *c*.

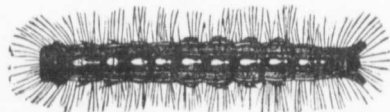


FIG. 45.

The caterpillar is also very like that of the other species in colour and appearance, but may be distinguished from it by the series of white spots along the back, which in the Apple Caterpillar are united into a continuous line. Compare Figures 45 and 42 and the difference will be plain at once. The moth (Fig. 44*b*) resembles its congener in general colour and appearance, but may be distinguished by its paler or more yellowish colour and by the transverse bars on the wings being dark brown instead of white.

Very much the same methods may be employed against this insect in all its stages, as have been recommended for the other species. The most important difference in habit is that the Forest Caterpillar spins a web against a bough or on the trunk of a tree instead of a tent in a fork, and congregates at times on the outside of the web instead of beneath it. When gathered together in this way numbers may easily be destroyed by crushing them with a stick or pole. These insects are very voracious feeders, and if let alone

will speedily defoliate a tree. As they attack many ornamental shade trees as well as those in the forest and sometimes extend their ravages to fruit trees, they should be ruthlessly exterminated wherever they are met with.

We have now remarked upon some of our most common insect pests, and have endeavoured to furnish the reader with the most approved modes of dealing with them. We shall feel very thankful to any one who tries any of these remedies if he will be good enough to let us know how far they have proved successful. The experience will be of much value to us and we shall probably be able to make it of service to others.

A TRIP TO NEPIGON.

SOME NOTES UPON COLLECTING AND BREEDING BUTTERFLIES FROM THE EGG.

BY JAMES FLETCHER, OTTAWA.

It is a recognized fact in Economic Entomology that the most important investigations are those by which the life-histories of insects are made out, in order that the most appropriate remedies may be adopted for injurious species. In Scientific Entomology these investigations are no less important, but are undertaken with different objects in view. For the accurate determination and separation of closely related species, it is frequently necessary to know an insect in all its stages from the egg to the perfect form. In no branch of Natural History is this more necessary than with some of our Diurnal Lepidoptera—the butterflies—those living flowers which flitting from blossom to blossom add such an unspeakable charm to the summer landscape. In the North American insect fauna we have some very large genera, as the Fritillaries (*Argynnidæ*) and the Clouded Yellows (*Coliades*). These contain many closely allied species, and it would actually be difficult in all cases to identify with certainty the perfect insects, without a knowledge of the preparatory stages, and some have only been shown to be distinct by breeding from the egg, and noting carefully the points upon which they constantly differ in their various stages of growth. Whilst, in the first case, the exact scientific identification of the insect, its classification, name and specific value are of little interest, so that so much of its habits can be discovered as will enable us to put a stop to, or prevent a recurrence of its ravages; in the other case, the exact identification and correct classification are the important points aimed at. Sometimes, as in the well-known cases of *Papilio Ajax*, *Colias Eurytheme* and *Grapta Interrogationis*, several apparently very different varieties have been shown to be merely varietal forms of one species, and the interesting discovery has been made that one or other of these forms preponderates at certain seasons of the year. These discoveries are chiefly due to the constant and untiring labours of Mr. W. H. Edwards, of West Virginia, who not only himself patiently and persistently perseveres in his studies, but has also taken great pains to induce others to help in the work. His kindness and prompt attention in advising and helping others cannot be too highly spoken of. In the *Canadian Entomologist*, for 1885, appeared some admirable articles upon breeding from the egg, in which the results of his long experience were given. These have been of great assistance to those who have taken up this most interesting branch of entomology, and the writer acknowledges with gratitude his own indebtedness. Those who have never caught a butterfly and caged it to obtain its eggs, and then bred these to maturity, cannot form the slightest idea of the all-absorbing interest and pleasure that attend these observations. Moreover, their utility, as teaching what to observe, how to observe it, and then how to record what is seen, so that it may be of use to others, cannot be over-estimated. At first, of course, there are some difficulties, but with a little practice these can be overcome. This fact is particularly manifest in drawing or describing the young caterpillars at the different moults. All caterpillars change their skins four or five times after they leave the egg, so as to allow for the rapid increase in size of their growing bodies. At all these moults, important changes in the structure and in the markings of the skin take place, and for this reason they

should be carefully examined at each moult. This is not at all a new idea that great care should be taken in rearing females by mere means. The eggs of *Pieris Napi*, P. eggs hatch after a short period in the receptacle which they are in, and better they may be reared in a better and much valuable plant, or by water. The student by the day, egg-laying, will find it a good food of allied species.

The field, to the most merest tyro may be sent paper to give S. H. Scudder, or then gained and have not yet taken.

Our trip to Nepigon and back picturesquely situated waters from the into Nepigon Bay Superior. It is water into the lake other river in Canada summer there is their luck with lake.

The village and two stores, a half a mile from Red Rock, now remembers anyone advice and assistance approach it by the which spans the the view. Awa Nepigon Bay with river gradually banks. A glimpse and the rest of the top with trees and has cut out in height. Look sheet of water, and bounded on wooded banks to of the two, and ving at Nepigon most clean and once with our net.

It may not to Nepigon in part.

should be carefully described and the head case should always be preserved at each moult. The skin cannot as a rule be preserved, for the young caterpillar after having worked it off generally devours it at once. There is a prevalent idea that great difficulty attends the obtaining eggs and rearing the larvæ; but this is not at all the case; a few eggs of many species may be obtained from ripe females by merely shutting them in a pill box. In this way I have secured eggs of *Pieris Napi*, *P. Rapæ*, *Thecla Niphon*, *T. Calanus*, *Lycæna Lucia*, etc., etc. These eggs hatch after a few days and then all that is necessary is to put them in any small receptacle which will prevent their food from drying up, as a tin box or glass jar, or what is better they may be placed upon a living plant out of doors. Many eggs may be obtained and much valuable information may be gathered by hunting for the eggs upon the food plant, or by watching the females in nature. The action of butterflies when intent upon egg-laying, will soon be recognized, and patient observation will frequently reward the student by the discovery of an unknown food plant. A knowledge of the habits and food of allied species even in other parts of the world will frequently assist greatly.

The field, too, is so large and the amount of work yet to be done, so great that the merest tyro may hope to obtain good results in a very short time. I purpose in the present paper to give an account of a collecting trip I had the privilege of making with Mr. S. H. Scudder, of Cambridge, during the past summer. I believe that the experience then gained and a description of the apparatus used will be of assistance to others who have not yet taken up this fascinating study.

Our trip together was made in the beginning of July, and was from Ottawa to Nepigon and back. Nepigon is a small station on the Canadian Pacific Railway, very picturesquely situated at the mouth of the rapid river Nepigon, which brings down the icy waters from the lake of the same name, about fifty miles due north; and discharges them into Nepigon Bay, the most northern point of that great triangular inland sea, Lake Superior. It is claimed for this river, that it is the only river which discharges clear water into the lake, and that its trout are larger and fishing better than those of any other river in Canada. Be this as it may, it has gained such celebrity that during the summer there is a constant stream of visitors who come for a week or fortnight to try their luck with Nepigon trout, and the verdict of all seems to be "we must come again."

The village consists of the railway station, which is also used as a church, an hotel and two stores, as well as several surveyed lots for the site of the future town. About half a mile from the railway, by the side of the river is the neat Hudson Bay post of Red Rock, now presided over by the genial and courteous Mr. Flanigan, who always remembers anyone he has once met, takes an interest in their pursuits and is ready with advice and assistance whenever required. Nepigon is very prettily situated; as you approach it by the railway from the east, the first glimpse you get is from the iron bridge which spans the river half a mile from the station. Then a charming picture bursts on the view. Away to the left lies a long range of hills, behind which are the lake and Nepigon Bay with its islands and indented shores. They are some miles away and the river gradually widening, winds its way down to them amongst green fields and wooded banks. A glimpse is got of the pretty Hudson Bay post with its neat white building and the rest of the landscape is filled in by the high banks of the river, thickly clothed at the top with trees. After passing beneath the bridge the river swings away to the right, and has cut out from the clay an extensive bay, leaving a steep cliff of clay over 100 feet in height. Looking out on the other side, up the river you see Lake Helen, a beautiful sheet of water, stretching away to the north for eight miles, with a width of one mile, and bounded on its eastern side by a rocky ridge of Laurentian gneiss and with elevated wooded banks to the west or left. "The Ridge," as we called it, to the right is the higher of the two, and was found to be bare rock in many places with little vegetation. Arriving at Nepigon station we took our traps to the Taylor House, an excellent hotel, most clean and comfortable, and having made arrangements for meals, we sallied forth at once with our nets to "look at the locality."

It may not be amiss to stop here for a few moments and explain what brought us to Nepigon in preference to any other place.

That there was some strong attraction it will be readily granted. I had gone there from Ottawa (808 miles) two years running, before this season, and had now persuaded Mr. Scudder to come all the way from Boston to accompany me.

I have elsewhere mentioned that in 1885 Professor Macoun brought back with him from this locality a collection of butterflies. In this collection were some of exceptional interest and one of which was a great surprise. This was a new species of the Arctic genus *Chionobas* (or *Eneis*, Hüb.). It was a surprise not so much from being a species of that genus but from being of a distinctly western type. It resembles most nearly *Ch. Californica* of the Pacific coast and is a large species, expanding from 2 to 2½ inches. Besides this there were several specimens of *Colias Interior*, Scud, *Argynnis Electa*, Edw.; as well as many other insects, and amongst them a small *Chrysophanus*, of which Mr. Edwards says "it may be *Florus*." I am of the opinion that it certainly is not *Helioides*, Bd., but it seems to me to approach more nearly to *Dorcas*, Kirby, and *Epicanthe*, B. L. The female is the same size as *Dorcas* and the spots are almost identically the same. In the Nepigon species, however, the colour of the upper surface is deep purplish brown, and upon both primaries and secondaries, between the margin and the post-median band of black spots, is a band of orange lunules running out to the broad margin from each spot on the primaries. These are larger and longer outside the three lowest spots, corresponding with the greater distance of these three spots from the margin than the three uppermost. On the secondaries the orange spots are much smaller and the continuous band although discernible is indistinct towards its upper end. The coloration of the under side is very rich, being bright rusty orange, slightly washed with purple over the secondaries and at the apices of primaries. The spots and marks, as on the upper side, are like those of *Dorcas*, of which indeed this form is possibly a variety. I have mentioned it here at some length because it has not been taken again at Nepigon since Professor Macoun took the five specimens he brought back with him. Specimens identical with these were sent to me by Dr. W. Brodie, of Toronto, who took them at Tobermory in the same district in September.

Now, the eggs of the species I have mentioned and those of *Carterocephalus Mandan* were our particular desiderata and these were the attractions which led us to Nepigon in preference to nearer places.

The whole fauna and flora of the locality are, however, of particular interest from their northern character. The geographical position of Nepigon is about lat. 49°, lon. 88°, and apart from its northern position it has a cooling influence exercised upon it by the proximity of the large mass of cold water found in Lake Superior. The difference in the state of development of the plants here and at Ottawa was at once noticeable when we left the hotel and began to search for the treasures we had come for. In the clearing round the station and "village" wild strawberries and raspberries were still in flower, and the white stars of *Cornus Canadensis* were a conspicuous feature. In the woods the Lake Superior Nodding Trillium, *T. declinatum*, was still in flower, together with *Clintonia borealis*. A variety of *Rosa blanda* was just beginning to expand, and the bushes of *Amelanchier Canadensis* were a beautiful sight. *Streptopus roseus* and *Actæa alba* were everywhere abundant beneath the trees, and amongst the mossy stumps *Coptis trifolia* and *Mitella nuda* opened their gemlike flowers. By the river banks magnificent clumps of *Caltha palustris*, the marsh marigold, caught the eye. All these are spring flowers which at Ottawa expand their blossoms in the middle or end of May, and although there were some flowers of a later date amongst them, the character of the flora was such as we had seen at Ottawa at least a month sooner. We learnt upon enquiry that upon the 1st of June the woods had a great deal of snow in them and the ice had only lately left the river.

The collecting grounds at Nepigon may be described as follows:—Starting from the hotel near the railway and going down to the Hudson Bay post is a tract of low woodland and beyond this are the fields and meadows belonging to the Hudson Bay post. Opposite the hotel and north of the railway is a road running back into the woods, and parallel with Lake Helen. This is called "the wood road," and is used in the winter time to bring down firewood from the high lands beyond the clearing. Turning westward along the track, high rocks and banks soon come down to the railway on the right

hand side; but the entomologist-glade," the homolocality lies in the pass down through your right hand with small spruce this runs away to

Upon July the necessary apparatus for each the other for 4 inches by 3 a supply of pill making cages, and having removed place by an elastics yards were passed receiving the bus at once. Passing clumps of *Mertensia* profusion of purple flowers of a real found was very few pugnacious strange. It belongs to *itoba*. What is eggs were secured turned in by a beetle the greatest profusion except perhaps we found here. Orthoptera, Diptera and Diptera and the Nepigon as well flies, sand-flies, variety for ever vengeance. The acid and forethought. acid, applied to the doors. Some people that "flies don't selves. These people the prevention is immunity from a to bed. The record to Macoun's glad of the place and the glade, I was spot where the one and sprang out in first specimen of Hurrah! well done before at exactly and had begun to the locality. It is a dent of getting e

hand side; but to the left are low woods with open grassy glades which at once tempt the entomologist—nor will he be disappointed for this is the now celebrated "Macoun's glade," the home of *Chionobas Macounii* and many other little beauties. The other locality lies in the opposite direction, and turning eastward after leaving the hotel you pass down through a hot gravelly cutting and cross the iron bridge over the river. On your right hand you have high woods and on the left an extensive swamp thickly covered with small spruce and tamarac. About a mile from the bridge the Ridge is reached and this runs away to the north until it reaches the shores of the lake.

Upon July 5th we reached Nepigon at 12:20 p. m. and by 1 o'clock had unpacked the necessary apparatus, had disposed of dinner and were ready to start. Our apparatus for each collector, consisted of a net, two cyanide bottles, one for lepidoptera the other for grasshoppers, etc., a bottle of spirit for beetles, and a flat tin box 4 inches by 3 and 1 inch deep filled with envelopes for butterflies, as well as a supply of pill boxes for boxing living females and a yard or two of netting for making cages. Before leaving the hotel we picked up half a dozen empty tomato cans and having removed the two ends we covered one of them with a piece of netting kept in place by an elastic band. We were now ready and turning westward, before many yards were passed we were arrested by a clump of *Anaphalis Margaritacea* which was receiving the busy attention of a female *Pyrameis Huntera*; she was secured and boxed at once. Passing on along the line we found the banks on either side resplendent with clumps of *Mertensia paniculata*, a beautiful plant with rich deep-green leaves and a profusion of pure blue bell-shaped flowers which hang pendent from small branchlets. Flowers of a real blue are very uncommon in nature and to see such profusion as we here found was very charming. Darting around these flowers with lightning swiftness were a few pugnacious skippers. We caught one specimen which was at once recognised as strange. It belongs to the "Comma group" of Pamphila and somewhat resembles *Manitoba*. What is probably the same species was afterwards taken on "the ridge" and eggs were secured. After passing a deep gully a few hundred yards along the track we turned in by a bridle path towards Macoun's glade. Insects of all descriptions were in the greatest profusion and this is undoubtedly a character of this locality. In no place, except perhaps Vancouver Island, have I seen such enormous numbers of specimens as we found here. The air seemed to be filled with them. Hymenoptera, Lepidoptera, Orthoptera, Diptera—Ah! the very word carries me back in thought. Yes. There were Diptera and the character of the locality was carried out—they were in profusion. Nepigon as well as being famed for its trout is famed for its "flies," mosquitoes, black-flies, sand-flies, tabanus, chrysops. Oh! The thought of them!! An appropriate variety for every hour of the day and they all carried out their mission in life with a vengeance. They could however be kept within reasonable bounds with a little care and forethought. "Mosquito oil" composed of sweet oil, oil of penny-royal and carbolic acid, applied to the face and neck and backs of the hands was found to be efficient out-of-doors. Some people however are too obstinate to use this harmless unguent averring that "flies don't trouble them much," and they don't like putting such mess on themselves. These people however sometimes have to suffer severely and it will be found that the prevention is well worth the trouble. In our bedrooms at night we enjoyed perfect immunity from attack by burning a small quantity of Pyrethrum powder before we went to bed. The recollection of that phalanx of bloodthirsty flies which met us at the entrance to Macoun's glade has led me to digress somewhat; but at any rate they were a feature of the place and a most noticeable one. As we stepped into the pathway which leads into the glade, I was carefully pointing out to my companion that we were now in the exact spot where the original type specimens were collected, when he rushed by me with a yell and sprang out into the bushes, exclaiming, Look out! There is one—here it is! and the first specimen of *Chionobas Macounii* was secured—a minute later I had another. Hurrah! well done. We were now in a high state of glee. I had been to Nepigon once before at exactly the right season and again a month later, but had not seen a specimen, and had begun to think that perhaps after all there might possibly be some mistake about the locality. It was all right now, though, and as we were to stay a week we felt confident of getting eggs. We took four more males on the 5th of July. We examined

thoroughly this beautiful glade and collected several specimens, but the most important part of the afternoon's work was settling upon a spot for our cages. For ease in examining them, these were all placed near to each other.

In the glade was a great profusion of flowers and grasses, a few spruces, cedars and pines mixed with poplars, aspens (*Populus tremloides*) and birches, all of which were dotted about in a waving sea of grasses. The most conspicuous and abundant of which were, in the low parts *Avena striata* and *Poa debilis*, together with a profusion of low Carices, *C. bromoides* being very plentiful. Upon a sandy bank towards the railway *Danthonia spicata* grew in tufts with *Carex Houghtonii* and other lower species of carex. Amongst them *Convolvulus spithameus* opened its glorious white corollas. To the western end of the glade was a dry swampy tract, or rather a dry track where were growing many plants which in the east only grow in wet bogs and swamps. The Labrador tea (*Ledum latifolium*), *Cassandra calyculata*, *Viburnum cassinoides*, Kalmias, Eriophorums, Sphagnums and *Drosera rotundifolia* were all here in luxuriant profusion. Willows of various species were everywhere. Through the centre of this glade runs a path which had been used during the construction of the railway, and along this as everywhere through the country where hay has been carried for horses, red and white clover and timothy grass grow abundantly. Beyond this swampy corner the ground rises again and is covered with trees and bushes. Upon this elevated knoll was the only place where we took *Lycæna Comyntas* and *L. Couperi* neither of which were abundant. Before leaving the glade for the night, we caged Pyrameis Huntera over a plant of *Anaphalis margaritacea*, this is too large a species for confining in a tomato can cage, so another kind had to be constructed. This is made by cutting two flexible twigs from a willow or any other shrub and bending them into the shape of two arches which are put one over the other at right angles with the ends pushed into the ground; over the pent-house thus formed a piece of gauze is placed, and the cage is complete. The edges of the gauze may be kept down either with pegs or earth placed upon them. This kind of cage was used for all the larger species which lay upon low plants. Besides the specimens of *Ch. Macounii* we had taken many other species of butterflies, moths, beetles and flies. Among the moths several specimens of *Nemeophila Selwynii* another new species discovered by Prof. Macoun in this locality. When we got home in the evening we found that a party of American fishermen had arrived and in the hour before tea had already stocked the larder with Nepigon trout, the reputed excellent qualities of which we afterwards tested and unanimously concurred in. The evening was pleasantly spent enjoying Mrs. Flanigan's genial hospitality, and after we got home labelling, dating and packing away our specimens. This is a most important duty and must be done every day. Nothing is so easy to forget as the exact date or locality of a specimen, and when this is lost much of the value of the specimen is gone. We never allowed fatigue or any other cause to induce us to put off this part of our work till the morrow.

The delicious cool nights were a great treat to us after the exceedingly hot weather we had both experienced during June, and we appreciated all the more the cool breezes, the exhilarating air and the refreshing bathing in the icy Nepigon, when our daily letters kept telling us of the great heat which was prevailing at this time throughout the greater part of Ontario and the Northern States.

The next morning we were up early, note books were written up and preparations made for the day. We found that few insects were moving before 8.30, so we seldom started until that hour. Our daily routine was as follows:—Write up notes before breakfast, visit the cages after breakfast, then work down to the river about noon, and take a swim, call at Mr. Flanigan's to receive and post letters, dinner at one; collect in the afternoon. After tea walk a mile down the track to a delicious spring and bring back a tin pailful of water for drinking. After this one pipe, then label, discuss and put away the captures of the day, and go to bed. On the 6th we started off at once to Macoun's glade with the set purpose of getting females of *Macounii*, and, as is generally the case when one starts with a set purpose, we were at last successful. As we stepped out into the glade there sailed away from our feet a bright brown butterfly, with black stripes. So much of the size, appearance and graceful flight of *Limenitis Disippus* as almost to have escaped our notice. Something about it, however, seemed

different, and a few men of female *M. nervures* all dark black ocelli with very much. Most ocelli and the new and particularly Rocky Mountain Morley is the o feature is the to *Androconia*, which nine females, and When we left we tributed to everyo spicuous objects a seen to lay an egg ring half a dozen tree. This was *Limenitis* and Gr inside may be in a place their eggs. leaves, *Limenitis meis* Huntera, Co flower stems. A lay indiscriminate *Turnus* it was ne When a bag ma gauze over a bran will be sure to ge by spiders from t same cage. I ha settle on the top three they distur when they will *Colias Eurythem* by his impatient the top and every crawling to the t

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The *Colias* w It will be found by rail to collect have done so. E and are very litt (ferred) for Satyrids. Nearly, if from this year's violet (*V. blanda* Argynnidae. If the pots of grass be the food of a l ance of sand flies gathered at the s

On Monday ing the Zoologica

different, and a few steps and the well-known twist of the wrist, captured our first specimen of female *Macounii*. Oh, but she was a beauty! Colour bright brown, with the nervures all darkened, and bearing on the primaries two large and white-pupilled black ocelli with one small one between them. The females we found to vary very much. Most of them were handsomer and darker than the males, with larger ocelli and the nervures almost always clearly marked out with black—some, however, and particularly one female taken by Professor Macoun in 1885, at Morley, in the Rocky Mountains, is of the beautiful pale golden brown of *Ch. Californica*. Morley is the only other known locality for this fine species. Its most interesting feature is the total absence in the males of the sexual streak of special scales, or *Androconia*, which marks the males of this genus. During the day we secured altogether nine females, and tied them in three cages over clumps of grass, (*Avena striata*). When we left we carried away with us upwards of 250 eggs, which were afterwards distributed to everyone we knew of who would take the trouble to rear the larvæ. Conspicuous objects at this time were the Yellow Swallow-tails, (*P. Turnus*), and one was seen to lay an egg upon a small aspen. This was a new food plant to us both, so capturing half a dozen females they were tied in a gauze bag over a branch of a living aspen tree. This was another kind of cage, and is very useful for such insects as *Papilio*, *Limenitis* and *Grapta*. Care must be taken, however, that the leaves of the branch inside may be in a natural position, for some species are very particular about where they place their eggs. For instance, *Nisoniades-Icelus* and *Papilio Turnus* lay on top of the leaves, *Limenitis* on the edge near the tip, and many others as *Danais Archippus*, *Pyrameis Huntera*, *Colias Eurytheme*, underneath. Some, as the *Lycænas*, lay upon the small flower stems. A few, as *Argynnis Myrina*, *A. Bellona* and some of the *Pamphilidæ* will lay indiscriminately all over the food plant, the ground and the cage. With *Papilio Turnus* it was necessary to tie our bag so that the branch hung naturally inside it. When a bag made beforehand is used the points must be rounded, and in tying a piece of gauze over a branch care must be taken to pull out all creases and folds, or the insects will be sure to get into them and either die, or as we found in some instances, be killed by spiders from the outside of the bag. It is better to put more than one female in the same cage. I have frequently noticed that one specimen alone is apt to crawl about or settle on the top of the cage, and not go near the food plant. When there are two or three they disturb each other and are frequently moving and falling upon the food plant, when they will sometimes stop for a second and lay an egg. A stubborn female of *Colias Eurytheme* was only induced to lay by having a male placed in the cage with her, by his impatient fluttering and efforts to get out she was frequently knocked down from the top and every time she fell upon the clover plant beneath she laid an egg before crawling to the top again.

By the evening of the 7th we had the following species caged:—*Papilio Turnus*, *Colias Eurytheme*, *Pyrameis Huntera*, *Chionobas Macounii*, *Pamphila Mystic*, *Amblyscirtes Vialis*, *Nisoniades Icelus*.

The *Colias* was tied upon a plant of clover (*Trifolium pratense*) I had taken with me. It will be found a wise precaution to take with you a few plants in pots when travelling by rail to collect eggs. I have practiced this for years and have always been glad that I have done so. Half a dozen 3-inch pots will fit easily into a fruit basket with a handle, and are very little trouble. In these you can take two pots of grass (*Poa pratensis* preferred) for *Satyridæ* and *Pamphilidæ*, a plant of red clover and one of white clover for *Coliads*. Nearly, if not all these species will lay upon these plants, although it would appear from this year's experience they will not all eat them. One pot with a smooth-leaved violet (*V. blanda*) and one with a rough-leaved species (*V. cucullata*). These are for the *Argynnidæ*. If grass is abundant and in convenient tufts for caging insects upon, one of the pots of grass may be emptied and the pot used for any local plant which is thought to be the food of a local species. On Sunday, 8th, the only note of interest was the appearance of sand flies in such numbers as to almost drive out the little congregation which gathered at the station-house for service.

On Monday morning, the 9th, we got up early and made an early start. After visiting the Zoological Garden, as we now called our vivarium, we fought our way through a

thick swampy meadow overgrown with willows, down to the river's edge, in hopes of finding *Chrysophanus Florus*. We were, however, unsuccessful in this effort. Up to this time we had not seen a single *Colias Interior*, although a hundred miles east on our journey up we had seen them in abundance along the line of railway. On this account we decided to return the way we came, instead of going, as we had arranged, down the lake by steamer. Even if the species appeared before we left it could only be the males now, as they precede the females by about a week. We had seen them abundant at Sudbury, so decided to stop over there on the way back. There also lived Mr. J. D. Evans, an enthusiastic collector, and one who was specially interested in *C. Interior*.

In the afternoon we made an expedition up the wood road. Here we secured two female *Carterocephalus Mandan* and numerous examples of *Phyciodes Nycteis*, *P. Tharos* and *Lycæna Lucia*. *C. Mandan* was one of our special desiderata. We had taken several males, but these two females and another were the only ones we caught. They were at once, in deference to Mr. Scudder's wish, caged over *Poa pratensis*. This species was of particular interest to me, and after having bred the larva from the egg past the fourth moult to hibernation, I still find it one of the most interesting butterflies I know. It is rare but widely distributed. I caught my first specimen on Vancouver Island in 1885. The same year Professor Macoun took it in the Rocky Mountains, and Mr. J. M. Macoun took it at Lake Mistassini, and I have seen it in woods near Bobcaygeon, Ont. From the positive statement in European works that the larva of the very similar *C. Paniscus* feeds upon *Plantago*, I had tied specimens taken at Nepigon last year upon that plant, but got no eggs. I should have made the same mistake this year but for Mr. Scudder's knowledge. It illustrated well the value of experience.

Before we caged our two specimens he maintained that he did not believe *Plantago* was the food plant of our species, but said that if the egg proved to be ribbed, he would alter his opinion; if, however, it should be smooth and hemispherical, like those of the Pamphilidae, he was positive that grass was its food plant. As this was an important question, we decided that if another specimen were taken we would dissect it, and discover the nature of the eggs. Later in the afternoon this opportunity occurred, and the eggs were then discovered to be smooth, as he had anticipated. The correctness of his views as to the food, were also afterwards corroborated by the females laying on the grass and the young larvæ eating it readily, and refusing plantain leaves. The same day we caged *Amblyscirtes Vialis*, *Pamphila Cernes* and *Lycæna Lucia*. The first two on grass, the last on a flower-bearing twig of *Cornus stolonifera*, the Red-osier Dogwood. As we passed through the heavy herbaceous undergrowth, a sharp eye was kept on the stems of the *Epilobium angustifolium* for the larvæ of the rare *Alypia McCullochii*. In 1887 I discovered this to be the food-plant without recognizing the larvæ. Unfortunately no notes were taken of their appearance; all I can remember is that they were smooth and black, with yellow markings—more like the larvæ of *Eudryas*, I should say, than of *Alypia octomaculata*. I collected two larvæ and placed them in a jar with some of their food. The next morning they had buried, and not thinking they were of any special interest I did not unearth them. This spring I discovered, with chagrin, what they were, and that I had no description of the larva. The pupa was very similar to that of *Eudryas grata*, both in shape and colour.

This day marked an era in the records of our trip. I find it underlined in my diary. "To-day Chrysops first appeared in numbers." There seemed to be a plague of them. Directly we entered the woods we were set upon, and at last were compelled to put nets over our heads and wear handkerchiefs over the backs of our necks. Amongst the new captures of the day were one specimen each of *Lycæna Couperi* and *Argynnis Aphrodite*, the latter fresh from the chrysalis.

On Tuesday morning, 10th, *Argynnis Bellona* and *A. Myrina* were both tied over plants of *Viola renifolia*, and eggs were laid within a few hours. Upon clover flowers in a small meadow near the Hudson Bay Post, and, curiously, nowhere else, a few specimens of *Colias Philodice* were taken. In the woods the *Eurytheme* and *Keewaydin* forms of *Colias Eurytheme* were caught and tied on clover. After dinner we had decided that we would take a trip to "the Ridge." Soon after passing the railway bridge over the Nepigon, our first specimen of *Colias Interior* was bagged. What a lovely species it

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is. The colour, when once seen, is recognized again, even on the wing, at once. The clear brimstone yellow, and the conspicuous triple fringe, pink with a carmine streak in the centre, and the perfectly immaculate underside, make it a great favourite with all who have seen it in its native wilds. From this point, westward to Port Arthur, on Lake Superior, and eastward as far as Lake Nipissing, this beautiful species is abundant. During the afternoon we took nine specimens, all newly emerged males. To get to the ridge we struck off from the railway in a north-easterly direction, across a sphagnous bog. We found no insects of interest in the bog, although there was a profusion of flowering plants; the wild roses being very beautiful. We at last reached the ridge, and found the sides very precipitous. After a time, however, we came to the dry bed of a stream, and climbing up through the tangled growth of spiked maple, cedar, viburnum and cornel, we gained the top after a hard climb; here we found the vegetation much parched; flakes of moss slipped from the bare rocks as we trod upon them, and the leaves of trees and bushes were faded and drooping. In every shaded crevice grew mosses and bog plants—glorious Cypripediums (*C. acaule* and *C. parviflorum*), which it was impossible to pass by. Upon the bare, exposed rocks, in some places, grew patches of *Potentilla tridentata*, now in blossom, and the only flower growing out in the open sunshine. Here we took some more specimens of the little skipper, like *P. Manitoba*. They were very difficult to take, and when once disturbed, dashed off over the edge of the cliff. One specimen of *Ch. Macounii* was taken on the top of the ridge, after a most exciting chase. It rose from a wet bog some distance from the brink of the cliff, and we were sure that we had a specimen of *C. Jutta*, which species Professor Macoun had taken here at this time of the year. Nothing else of any particular interest, with the exception of some sub-arctic plants, was found on the ridge. *Lathyrus ochroleucus*, the Pale-flowered Everlasting pea was noticed in the rocky woods as we descended, and was noted as a possible food-plant of *Colias Interior*.

12th July. This was our last day, and we had a good deal to do before we left. Our cages had all to be examined, the eggs collected and packed, and the start for home to be made. In collecting butterflies for the cabinet, if good specimens are desired, it is necessary to kill them in a cyanide bottle. This is easily made, either by putting a small quantity of cyanide of potassium in a wide-mouthed bottle, or by cutting out a hole in the cork and putting a piece of the poison in the cavity. A convenient bottle I use myself, is made in this manner: the cyanide is kept in place by a piece of chamois leather, which entirely covers the cork, and is tied over the top like the mouth of a sack. I leave about an inch of the leather above the tie, and this is very convenient for holding the bottle, or extracting the cork with your teeth when both hands are occupied. But as cyanide of potassium is a deadly poison, great care must be taken not to get any of it upon the leather. By this upper portion, too, the cork is easily tied to the neck of the bottle, a precaution which will frequently save much annoyance and trouble, especially when mosquitoes are troublesome. A further precaution, which has many times been of service to me, is to tie a short piece of bright scarlet cloth to the neck of the bottle. It is a much easier matter than some would imagine to drop, lose, or even forget your cyanide bottle when stopping frequently to put away specimens, or make notes. Many times have I found a lost bottle by this means. When specimens are thoroughly dead, they should be taken from the poison bottle and dropped into envelopes. If left in the bottle they soon become rubbed and spoilt. Some specimens when dying, instead of closing their wings, open them right out until the two undersides meet. These may be left as they are, because the underside of every species must be shown in a collection. If, however, it is desired to close the wings, they should be taken out of the cyanide bottle, which makes them rigid, and left for a few hours, when the muscles will relax; or, on the other hand, they may be left in the poison bottle for 24 hours, or longer, and the same thing will take place. This last plan, however, is not a good one. The envelopes for lepidoptera are made by taking small squares of paper and folding them across, almost in the middle, so as to make a triangular form with one flap a little smaller than the other. When the insect is placed between the two flaps, the two edges of the larger one are folded over the lesser, and your insect is now ready to be labelled and packed away. Small cigar boxes are very convenient for carrying lepidoptera, or for sending them by mail.

When we came to pack up our live stock, we found that we had secured eggs of 17 species and varieties, all that we had tied but three. These three were *Grapta Progne*. A very much worn hibernated specimen was caught on the 9th, and being mistaken for *G. Satyrus*, was tied upon the wrong food-plant

Phyciodes Nycteis, tied on Solidago as an experiment to see if eggs would be laid.

Lycæna Lucia, two specimens got into the folds of the gauze, and were killed by spiders from the outside.

Some of our caged females were quite fresh, and as we thought we might get more eggs, sticks were bent over our potted plants, and they were caged and packed away in their basket for travelling. Amongst them were *C. Mandan* and the form *Eriphyle* of *Colias Eurytheme*. This last laid no eggs, and one only was obtained by a process which one of my correspondents calls "Egg laying extraordinary." It consists, simply, of gently pressing the abdomen of a female, which has died without laying eggs, until one, and sometimes two, perfect eggs are passed through the ovipositor. This method may, I believe, at some time, be useful in securing larvæ of rare species. My first female *Colias Interior* was taken in 1886, and died without laying. I then secured one egg, which hatched a few days afterwards; from not knowing the food-plant, however, it was lost. From a beautiful variety of *Papilio Turnus* I secured two eggs in the same way, both of which hatched. Fertile eggs were also got in this way from *Carterocephalus Mandan*, (and one of these was the only specimen I got through all its stages to full growth,) and from *Colias Philodice*.

There are one or two points which should be remembered when obtaining eggs and rearing larvæ. In the first place the females should not be left exposed to the direct rays of the sun; but it will be found sometimes that if a butterfly is sluggish, putting her in the sun for a short time will revive her and make her lay eggs. Confined females, whether over branches or potted plants, should always be in the open air. If females do not lay in two or three days they must be fed. This is easily done. Take them from the cage and hold near them a piece of sponge (or, Mr. Edwards suggests evaporated apple) saturated with a weak solution of sugar and water. As soon as it is placed near them they will generally move their antennæ towards it and uncoiling their tongues suck up the liquid. If they take no notice of it the tongue can be gently uncoiled with the tip of a pin when they will nearly always begin to feed. It is better to feed them away from the plant they are wanted to lay upon, for if any of the syrup be spilled upon the flower pot or plant it is almost sure to attract ants. I kept one female *Colias Interior* in this way for ten days before eggs were laid. When eggs are laid they should as a rule be collected at short intervals. They are subject to the attacks of various enemies—spiders, ants, crickets, and minute hymenopterous parasites. They may be kept easily in small boxes, but do better if not kept in too hot or dry a place. When the young caterpillars hatch they must be moved with great care to their food plant; a fine paint brush is the most convenient instrument. With small larvæ, or those which it is desired to examine often, glass tubes, or jelly glasses with a tight fitting tin cover, are best. These must be kept tightly closed and in a cool place. Light is not at all necessary, and the sun should never be allowed to shine directly upon them. If moisture gathers inside the glasses the top should be removed for a short time. Larvæ may also be placed upon growing plants. These can be planted in flower-pots and the young caterpillars kept from wandering, either by a cage of wire netting, or by, what I have found very satisfactory, glass lamp chimneys. These can be placed over the plant, with the bottom pushed into the earth, and then should have a loose wad of cotton batting in the top. This has the double effect of preventing too great evaporation of moisture and keeping its occupants within bounds. Some larvæ wander very much and climb with the greatest ease over glass, spinning a silken path for themselves as they go. When caterpillars are bred in the study it must not be forgotten that the air inside a house is much drier than it is out of doors amongst the trees and low herbage, where caterpillars live naturally. The amateur will require some experience in keeping the air at a right degree of moisture, when breeding upon growing plants. In close tin boxes or jars, where the leaves must be changed every day, there is not so much trouble. An important thing to remember with larvæ in jars, is to

thoroughly wash out the jars with cold water every day. If, however, a caterpillar has spun a web on the side and is hung up to moult, it must not be disturbed. In changing the food it is better not to remove the caterpillars from the old food, but having placed the new supply in the jar, cut off the piece of leaf upon which they are and drop it into the jar. If they are not near a moult, a little puff of breath will generally dislodge them. Some caterpillars, as *Papilio Turnus*, which spins a platform to which it retires after feeding, can best be fed upon a living tree out of doors, but must be covered with a gauze bag to keep off enemies. A piece of paper should be kept attached to each breeding jar or cage, upon which regular notes must be taken at the time, giving the dates of every noticeable feature, particularly the dates of the moults and the changes which take place in the form and colour at that time.

The following is a list of Diurnals, of which I have seen specimens, taken at Nepigon. Some of the species were only taken by one collector, but most of them by all of us. The following record is of Prof. Macoun's collection, made in the last week of June, 1884; Dr. Bethune's, in the third week in August, 1888; my own in the last week in June, 1887, the first week in July, 1888, and the first week in August, 1886. The collection made in the first week in July is of course the trip above recorded, when I had the able assistance of Mr. Scudder:

Papilio Turnus, L.—July—Eggs laid freely on aspen.

Pieris Napi, Esper. Winter form *Oleracea-hiemalis*, Harr. Bred from eggs laid in 1887, by the next form.

Pieris Napi. Summer form *Oleracea-æstiva*. Bred from eggs laid by above form upon *Arabis perfoliata*.

Colias Eurytheme, Bd. Summer form *Eurytheme*, Edw.

Colias Eurytheme, Bd. Winter form *Keewaydin*, Edw. Of 36 eggs laid by the form *Eurytheme*, which I brought to maturity this summer, 33 were *Keewaydin*, 2 *Eurytheme*, and 1 questionably *Ariadne*, Edw.

Colias Eurytheme, Edw. Winter form *Eriphyle*, Edw. Not uncommon; eggs laid upon white clover.

Colias Philodice, Godt.—Uncommon.

Colias Christina, Edw. One female taken by Dr. Bethune, identified by W. H. Edwards.

Colias Interior, Scud.—Abundant in July and August, particularly in blueberry barrens; certainly single brooded; females lay after being caged on white clover for a few days, but the young larvæ (over four dozen) would not eat this plant. Two beautiful albino females were taken.

Danais Archippus, Fab.—Two remarkable wrecks, with only fragments of their wings, were taken on 9th July.

Argynnis Cybele, Fab.—August.

Argynnis Aphrodite, Fab.—July, August.

Argynnis Cipris, Edw. Some specimens taken by Dr. Bethune have been given this name by Mr. W. H. Edwards; they resemble *Aphrodite*, but the brown area beneath hind-wing is more mottled in *Cipris*, not so solid as in *Aphrodite*, yellow showing in between the nervures. Mr. Edwards has bred this species from the egg and says that while the larva of *Aphrodite* is chocolate brown, when full grown, that of *Cipris* is mottled with brown and yellow, and is one of the gayest larvæ among the *Argynnidae*.

Argynnis Atlantis, Edw.—Abundant; July, August.

Argynnis Electa, Edw.—First taken here by Prof. Macoun. It is a smaller species than *Atlantis*, lighter in colour, and some specimens seem to resemble the western *Lais*. This is also taken in Colorado, and its occurrence here is remarkable.

Argynnis Myrina, Cram.—Abundant; eggs laid on 10th July hatched and hibernated at once, without feeding.

Argynnis Chariclea, Schneid.—This is a late species. Dr. Bethune took two perfectly fresh specimens, 21st August. It is abundant at Port Arthur, 65 miles farther west, in the beginning of September. Identified by Mr. W. H. Edwards.

Argynnis Bellona, Fab.—Abundant; a handsome form, much darker than the usual one. A very fine melanic variety was taken on 2nd August, 1886.

- Grapta Comma*, Harr. Winter form *Harrisii*, Edw.—Some hibernated females.
Grapta Faunus, Edw.—Several fresh specimens were taken by Dr. Bethune in August.
- Grapta Progne*, Cram.—Common.
Vanessa Antiopa, L.—Common.
Vanessa Milbertii, Godt.—Common.
Pyrameis Atalanta, L.—Common.
Pyrameis Huntera, Fab.—Very common. The females laid readily on the under side of *Anaphalis margaritacea*, the Pearly Everlasting. The small eggs were pushed beneath the down and attached to the epidermis of the leaves. Over 100 eggs were obtained.
- Pyrameis Cardui*, L.—Common; eggs and larva common on thistle. Mr. Scudder collected one larva upon *A. Margaritacea*, with larvæ of *P. Huntera*. I have also bred it from sun-flower, Burdock and a white-leaved *Artemisia*, common in gardens.
- Limenitis Arthemis*, Dru. Form *Lamina*, Fab.—Abundant, especially along the railway, where refuse had been thrown out from the dining cars.
- Chionobas Jutta*, Hub.—Two females taken by Prof. Macoun, on 28th June.
Chionobas Macounii, Edw.—Local, but abundant in Macoun's glade, June 28 to July 13, when only faded and torn specimens were found.
- Thecla Irus*, Godt.—One specimen; Prof. Macoun.
Thecla Titus, Fab.—One specimen; Prof. Macoun.
Chrysophanus Thoe, Bd. Lec.—Two specimens; Prof. Macoun.
Chrysophanus Florus, Edw. (?)—Five specimens; Prof. Macoun.
Chrysophanus Hypophleas, Bd.—Not uncommon.
Lycæna Couperii, Grote.—One specimen; July.
Lycæna Pseudargiolus, Bd. Lec. Winter form *Lucia*, Kirby.
Lycæna Pseudargiolus, Bd. Lec. Winter form *Marginata*, Edw.; July, common.
Lycæna Pseudargiolus, Bb. Lec. Summer form *Neglecta*; two specimens, Prof. Macoun.
- Lycæna Comyntas*, Godt.—Local; not uncommon.
Lycæna Scudderii, Edw.—Three specimens; Prof. Macoun.
Carterocephalus Mandan.—Not uncommon; eggs on grass.
Pamphila Hobomok, Har.—Abundant; July; eggs on grass.
Pamphila Hobomok, dimorphic female *Pocahontas*, Scud.—Abundant; July; eggs on grass.
- Pamphila Manitoba*, Scud.—Not uncommon; August; eggs on grass.
Pamphila ——— "Manitoboides."—Not uncommon; June, July; eggs on grass.
Pamphila Peckius, Kirby.—One fresh specimen, first emerged, July 12; eggs on grass.
- Pamphila Mystic*, Scud.—Abundant; July; eggs on grass.
Pamphila Cernes, Bd. Lec.—Abundant; July; eggs on grass.
Amblyscirtes Vialis, Edw.—Abundant; June, July; eggs on grass.
Nisoniades Icelus, Lintn.—Abundant; June, July; eggs on a rough-leaved willow.
Eudamus Pylades, Scud.—Not common.

Concerning the above the following points seem to me worth recording, as adding something to the known life-histories of the species mentioned.

Colias Interior.—The food plant of this species is a mystery. It was thought that all species of *Olias* would feed upon white clover. This, however, is not the case, for *Interior* certainly will not. Several eggs were obtained during the past summer from females, taken at Sudbury, Ont., and from others, sent down to me alive, by mail, from Mr. J. D. Evans. These females were packed inside a tomato can, with a piece of cardboard at one end, through which a hole had been cut. A cover of gauze let in light and air. Inside the can were some stems of clover to give the insects a foothold. They arrived in perfect order after their journey of 320 miles, and after having been fed laid eggs. I may mention here, that butterflies may be sent alive for long distances by mail if properly packed. I have received, during the past season, from Rev. W. A. Burman,

of Griswold, Manitoba, living specimens of *Cænonympha Inornata*, which travelled to Ottawa (1,460 miles) inside a letter in a small flat tin box. Two specimens were laid on their sides with a green leaf between them, and when the box was opened at Ottawa, four days afterwards, they flew briskly across the room to the window. Unfortunately these were both males, but no doubt females would travel as well. The eggs of *Colias Interior* take exactly one week before they hatch. The egg is much like that of *Colias Philodice*. The young larva is lighter in colour.

The eggs, about four dozen in number, were equally divided between Mr. W. H. Edwards, Mr. Scudder and myself. We all tried them with every kind of leguminous plant we could obtain; but all failed to get the larvæ to feed. Some eggs were left upon the clover where they were laid until they hatched; but they, like the others, refused to eat, and after wandering about for two days dried up. Some were placed in a refrigerator at once upon hatching, but they fared no better than the rest. It seems to me worth mentioning, however, that in one jar where young larvæ were confined with leaves of several plants, they all gradually congregated upon the leaves of a *Desmodium*, and three specimens spun a small crescent of silk, somewhat similar to the silken path spun by young larvæ of *Colias Eurytheme* and *C. philodice*, to the end of which they go to feed and upon which they retire to rest. These three larvæ which spun these little silken crescents also passed a tiny pellet of pink excrement. They would not feed, however. The only *Desmodium* available was *D. Canadense*, a hairy species, and it is possible they could not get at the leaf on account of the hairs. At any rate the indications are that *Desmodium* is a possible food plant. A confirmatory fact is that one of Mr. Scudder's larvæ did exactly the same as my three, and spun its little crescent upon a leaf of *Desmodium*. *Lathyrus ochroleucus*, *Astragalus*, *Vicia*, *Pisum*, *Trifolium* all were refused. Mr. Scudder tells me that in Europe a species of this genus feeds upon *Vaccinium*, and a noticeable feature of all the localities, where I have taken *Interior*, is that bushes of this genus are abundant. Should I be fortunate enough to get more larvæ I shall offer them this as food.

Chinobas Macounii.—Eggs, large, globular; rather higher than broad, flattened at top and bottom; coarsely ribbed from top to bottom with about twenty ribs, a few of which divide at the bottom; between these are zigzag furrows crossing from rib to rib. Eggs laid on 6th July hatched on 26th, the larva eating a narrow strip from the egg shell round the top and then pushing its way out leaving the egg-shell almost intact. Very few of the larvæ ate their egg shells. The young larvæ are larger ($\frac{1}{8}$ inch) than those of *Ch. Jutta*, and have the heads more hairy; there are also a few black spots about the head which do not occur in *Jutta*. Upon the head and body of both species are some curious mammiform hairs. The larvæ are very sluggish, and seem to like to perch upon dead leaves of grass during the daytime.

The first moult took place about 18th August, after which the larvæ were four lines in length. Head round, flattened in front, greenish white, punctured, bearing on each side three stripes continuous with the stripes on the body and composed of the black hollows of the roughened surface; the two upper stripes join at their tips just above the ocelli. General colour, dull, glaucous, greenish white, with brown stripes.

On segment 2, just above and anterior to the spiracles is, on each side in both this species and *Ch. Jutta*, one long thoracic bristle curved forward. Food, Carices and Grasses.

Carterocephalus Mandan.—Two eggs were laid, 12th July, upon common lawn grass (*Poa pratensis*) and one was squeezed from the abdomen of a dead female. The egg is rather small, conically hemispherical; rather higher than wide; pale green. Duration, 10 days. The young larva is white, with black head and thoracic shield. The mature larva is slender and minutely downy, pale green in colour, with a white head and six narrow white longitudinal stripes. Along the body are two complete and one incomplete series of curious epidermal organs in the shape of chitinous concave disks which are sometimes geminate on the abdominal segments.

Pamphila ————— ?—Amongst the more interesting of our captures were a few specimens of an exceedingly active skipper, which was found in greatest numbers upon the top of "The Ridge." This insect belongs to the "Comma Group" of the genus

Pamphila, and bears a somewhat close resemblance to *P. Manitoba*, for which reason we call it "*Manitoboides*." It occurs, however, six weeks sooner at Nepigon than an insect I take to be true *Manitoba*. As I do not wish to cause confusion by naming what may prove to be a described species, I refrain from further describing the perfect insect, but give below some notes on the egg and the larvæ after the third moult, and on the appearance of the young larva in the first two stages. Five eggs were obtained upon the grass, *Danthonia spicata*. These were laid upon the green leaves and were large and showy, of a dull, dead white, and of the same shape as those of *P. Hobomok*. Under the microscope the shell presents a surprising appearance, for it is covered all over with threads and much resembles a piece of ordinary printing paper under a magnifying glass. The shell of the empty egg is very thick, and it is with difficulty that the pentagonal and hexagonal cells on the surface can be made out. Eggs laid 10th July hatched upon 25th. There was no mottling with pink as in *P. Cernes*, and the only indication that the eggs were good was the gradually darkening head of the young larva which showed through the thick shell. The newly-hatched caterpillar is of a much yellower shade of cream colour than either *P. Cernes*, *Mystic* or *Hobomok*. The head, thoracic shield and first thoracic foot, black. The whole body covered with knobbed hairs. Unluckily at the time the young caterpillars hatched I was moving into a new house, and my furniture and instruments all being packed up, my microscope was inaccessible, and the only observations I could make then were made with a Codrington lens. The shape of the young larvæ was sack-shaped, somewhat like the grubs of the Scarabæidæ; but not having the anal segments curved under the body. From the very beginning, when the young larvæ were placed upon a tuft of growing grass, they worked their way down to the bases of the leaves and kept out of sight. About four days after they hatched I lost sight of them, and it was not until 4th August that I found them again. They had evidently moulted, for instead of a yellowish white they had now assumed a delicate glaucous tint. By glaucous I mean an opaque white, with a faint bluish-green shade on the surface. The head, and spiracles, as well as the thoracic shield and first pair of thoracic feet were black as at first, making a continuous collar from the tip of one foot to the other. Down the centre of the back there was a green line, from the dorsal vessel showing through the skin. At this time they were transferred to a smaller tuft of grass consisting of small roots of *Agrostis vulgaris* and *Carex varia*. They seemed to eat either of these indiscriminately, and eating their way down into the heart of a shoot, would nibble the edges of the leaves all round them. Leaving none to attend the meeting of the American Association for the Advancement of Science, no note was taken of the date of the next moult. Indeed, I supposed that this, like some others, had died during my absence. One morning in the month of September, however, to my great pleasure, I found one of these larvæ snugly ensconced, head upwards, in a den it had eaten out of the centre of one of the shoots of sedge. When it emerged to feed I found it had quite changed its colour. In the beginning of October it came out of this den, and for some reason it did not return to it again, but climbed about on the grass and sedge, and before it had constructed another winter quarters the cold weather set in. In November it had spun together a few leaves of grass, but this seems to have been insufficient. Some warm weather in December caused a mould to spread all over the plant, and having decided that the caterpillar was dead, I placed it in alcohol. The following is a description of this larva after what I consider was its third moult:—

Length, 7 lines. General colour, greenish-brown, with head, thoracic shield and thoracic feet black. Head round, larger than either of the first three segments, very coarsely punctured and thickly invested with short pointed bristles. About the mouth-parts a few long bristles. Thoracic shield black on a pale collar, and having two longitudinal furrows and bearing some truncate bristles just above the large spiracle on segment 2. The shield is divided by a transverse line which cuts off a small triangular piece of which the apex points downwards just over the spiracle. This triangle bears one long setaceous bristle similar to those on *Chionobas Jutta* and *Macounii* and also one concave disk of the same nature as those on *C. Mandan*. The whole surface of the body is minutely shagreened and has the raised portions darkened. Besides this the whole of the body but the head is covered with small black tubercles, each of which bears a short white trumpet-shaped

hair which is apparently stellate, or bears a few short teeth, at the top. On the thoracic shield these are rather longer than on the rest of the body, but less clubbed. On the last segments there are a few long bristles, particularly upon the anal-flap. Beneath the body are also a few pointed bristles, upon the last two segments, and on the prolegs and thoracic feet. Thoracic feet black and bristly. Spiracles black and distinctly protruding (in the dead specimen). Concave disks. This species also bears two series of the processes mentioned under *C. Mandan*. In this instance, however, they are more like annuli. The edges of the disks being raised and black. They are arranged as follows: There are two series, all of which, except the pair on the base of the thoracic shield and a pair on the anal-flap, are below the spiracles. On seg. 2, above spiracle and on base of thoracic foot. Segs. 3 and 4, on base of thoracic foot, large. Seg. 5, just below second stigmatal fold, large; above it is what appears to be another disk, but which bears a truncate hair twice the ordinary length. Seg. 6—On upper stigmatal fold, in the same place as the bristle on previous segment, and below lower stigmatal fold. Segs. 7 to 10—On upper stigmatal fold and just above the foot of each proleg. Seg. 11—One large disk below stigmatal fold having just above it a similar one from which comes a long pointed bristle. On one side of the body this tubercle bears two bristles. Those on the feet each have below them two similar bristle-bearing disks. Seg. 12 has one large disk with two or three bristle-bearing tubercles round it. Seg. 13 has a small one at the base of the second stigmatal fold in a line with the spiracles, and also another small pair above, one on each side of the anal-flap.

P. Cernes, B. L. (*Limochores taumas*, Fab.)—The form of this species which occurs at Nepigon is very dark, so dark as frequently to have been mistaken for *A. Vialis* when we were collecting. Several females were caged over a tuft of cut-down *Avena striata* and five eggs were secured on 10th July. These were all laid loose amongst the dead leaves on the ground. Hemispherical, dull ivory white, large for the size of the species—larger than those of *P. Mystic*. The surface of the shell finely netted all over with irregular pentagonal and hexagonal cells. On 16th, the surface became mottled with ruddy blotches and two or three days later the dark head of one of the young larvæ began to be apparent, it hatched on 23rd July. The young larva was cream colour at first with a black head and thoracic shield. After the first moult, which took place on 30th July, it was darker on the anal segments, and after the second moult, on 4th August, was quite rusty brown over the last segments. On 13th August it moulted the third time, and then the colour of the whole body changed to a dark brown, and the length was a quarter of an inch. On 29th August the fourth moult took place, and the following description was taken on September 8th:—Length when walking, 1 inch. General colour, rich purplish-brown with a green tinge showing through the transparent skin. Contractions of dorsal vessel plainly visible, giving the appearance of a dark-brown dorsal stripe. Surface of body finely mottled with grey and dark purplish-brown, and, like the head and thoracic shield, covered with a fine short black pubescence. Head black, coarsely punctured and pubescent. The thoracic shield black and shining, reaching from the spiracle on one side of Seg. 2 right round to the other. This is very conspicuous by reason of being placed upon a milk white collar. The spiracles black, on Seg. 12 large and high up, giving with some marks on anal flap the appearance of a bear's face. On anal flap the dorsal stripe ends in a blackish triangle, on each side of which are two small sub-dorsal black comma-like dashes, running backwards half way to the exterior margin of the anal flap, which is black above, whitish beneath. Down the back are two rows of tubercles, sub-dorsal and lateral, which perhaps answer to the concave disks of *C. Mandan*. As there was only one of these young larvæ, I kept it in a glass tube for better examination, and it turned out to be a very interesting captive. Instead of making a tent by catching the opposite edges of leaves together, it spun a nest against the side of the bottle and would extend itself from the nest and eat its food. After third moult, it was removed to a tin-topped jelly glass. Here, too, it spun a cocoon-like nest from which it reached forth and ate its food. On September 8th it appeared sluggish and I thought it was going to pupate. It was almost an inch long and I knew must be full grown, so it was placed in a tuft of grass, where it very soon spun a cocoon amongst the leaves close

to the root and remained in a semi-torpid condition, sometimes coming out on warm days and eating a little. On 13th October I found that it had pupated, and I was thus in possession of the complete life-history of the species. The chrysalis which was contained in a light cocoon about an inch long, made by catching a few blades of grass together and lining them with silk, was almost erect and seemed to be kept from lying against the cocoon by a few strands of silk. Chrysalis six lines in length, head-case square in front, eye-cases large and bold, between the eyes and on each side of them are tufts of tawny hair, with which the thorax and abdomen are also invested. Wing, leg and antenna cases smooth. Abdomen at 3rd segment covered laterally by the wing-cases and slightly wider than thorax or eyes. On segments 4, 5, 6 of the abdomen, beneath, the prolegs of the caterpillar are still visible. Meso-thorax tumid and bearing upon its anterior margin, behind the eyes two elevated tuberculated prominences, in front of which in the furrow between the pro- and meso-thorax is the opening of the thoracic spiracle. Wing-cases extending to the middle of the 4th abdominal segment, from their apices the tongue-cases run free and disconnected to the posterior margin of the 7th abdominal segment. There are also two shorter and wider cases which exceed the wings and run free to the posterior margin of 5th abdominal segment. These are probably the extremities of the cases of the metathoracic pair of legs. Upon the dorsal surface of the abdomen are two series of small concave disks, a sub-dorsal anterior series and a lateral posterior series, one pair upon each abdominal segment. Cremaster consisting of a few large rounded hooks. The colour of the head, leg- and antenna-cases, black. Wing-cases at first green and afterwards greenish-black. Pro-thorax black. Meso and meta-thorax brown. Abdomen light brown.

All grasses offered were eaten readily, *Panicum Crus-Galli* and *Triticum repens* perhaps with the greatest avidity, and *Phelum pratense* with the least.

Amblyscirtes Vialis, Edw.—This pretty little butterfly was caged on 9th in a tomato can, and the same day five eggs were secured, white shaped like those of *C. Mandan*, but rather larger. All were laid upon the green leaves of a cut down tuft of *Avena striata*. The young larvæ hatched on 20th, pretty little white caterpillars with black heads. As soon as they were placed on a tuft of *Poa pratensis* they crawled up to the tip of a blade and made a tent by drawing the opposite sides half way together with one strong strand of silk. Here they remained about five days, eating a little from the edge of the leaf and then disappeared. Their tuft of grass was left uncovered, and I think they were killed by the dryness of the air. They should have been covered with a glass.

Nisoniades Icelus, Lint.—A female of this species tied upon willow (*Salix cordata*) laid one beautiful greenish winged and netted egg on 10th July. This was the same as had been found upon willow bushes in the open and supposed to belong to this species, but the origin of which was now proved. My young larva was unfortunately drowned two days after hatching. Mr. Scudder carried his to the third stage. The eggs are laid upon the upper surface of the topmost leaves of willow bushes from six to eight feet from the ground, and were only found upon the willow above mentioned, which has rather rough pubescent leaves.

THE WHEAT MIDGE (*Diplosis tritici*, Kirby).

BY JAMES FLETCHER, OTTAWA.

Year after year this troublesome insect seriously injures the wheat crop of our Province, and there is no doubt that more systematic efforts ought to be made by farmers to reduce its ravages, or it is by no means impossible that it may develop into the dreadful scourge it was some years ago. In the year 1857 it destroyed one-third of the whole wheat crop of the Province. From that year down to about 1869 the injuries were very severe; but after that they decreased in an almost miraculous manner. Now, however, the effects of the Wheat Midge upon our wheat crops are complained of by millers and farmers from all quarters of the Province, and in some parts of Canada the cultivation of wheat is

being given up altogether. I believe that farmers must bestir themselves and take steps to check the operations of this insect by using the remedies suggested by Entomologists or it will assume the proportions of a widespread calamity.

This, like many others of our most injurious insects, is not a native of Canada; but was imported from Europe, and was probably a native of France. It was first noticed as injurious to wheat crops in England a little over one hundred years ago.

In the Philosophical Transactions of the Royal Society of England for 1772 Mr. C. Gullet gives a description of its injuries to wheat in England. It also feeds upon several wild grasses and it seems probable that its introduction into Canada was in hay used for packing—for it is difficult to understand how it could have come with wheat.

The wheat midge is also known under other names—"The Red Maggot" or "The Orange Maggot," "The Fly," "The Weevil." The first two of these names explain themselves and are given on account of the colour of the larvæ or maggots. The "Weevil" is a very inappropriate name, because the word "Weevil" properly belongs to the snout-beetles, different insects altogether. The Granary Weevils (*Calanda oryzae* and *C. granaria*) are the only insect which attack wheat to which the name weevil should be applied. These only attack stored grain and are never found in growing plants. The habit of giving the wrong names to insects gives much trouble and is frequently the cause of the wrong remedies being applied.

The life-history of the Wheat Midge as at present understood is briefly as follows: During the warm evenings of June when the wheat is just coming into blossom, clouds of tiny midges (Fig. 46) with black eyes and yellow bodies may be seen flying over the wheat-fields, or will be found in the room when the lamps are lighted and the windows left open. These are the parents of the "Red Maggot of the Wheat." The body of the female is prolonged into a long slender tube which can be extended and drawn in at pleasure. With this tube, which is called an ovipositor, she pushes her minute eggs (Fig. 47) down between



Fig. 46.



Fig. 47.

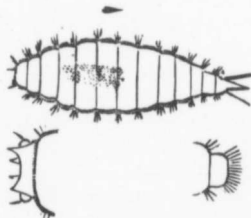


Fig. 48.

the scales of the florets of the spike of wheat. In a little over a week these tiny eggs hatch into transparent yellowish grubs which darken in colour as they grow older until they acquire the reddish orange colour, from which they take their names, the Red or Orange Maggot of the Wheat. As soon as the little maggots hatch they at once attack the young forming grain. Gnawing through the skin they suck out the juice of the "berry," close against which they lie, and prevent it from filling out properly and giving it the shrivelled appearance known amongst millers as "fly-struck."

When full grown the maggots (Fig. 48) either work their way up between the scales of chaff and drop to the ground, where they pass the winter, or they remain in the ears of wheat and are harvested with them. Those that fall to the ground penetrate about an inch beneath the surface where they spin a small cocoon of exceeding thinness, inside which

they remain in the larva condition until the next season. Shortly before they emerge in the perfect state they turn to pupæ, and a few days afterwards come out as perfect wheat midges. Those that remain in the ears also spin the same thin cocoon and remain in it all the winter. Probably the above is the general rule, the midges not being produced until the following summer; but it would also appear that some of them emerge the same autumn, Prof. Webster, of Purdue University, Indiana, has taken them as late as November, and has also bred them from plants of Volunteer wheat, in which he found them beneath the sheath of the leaf near the ground. From the above it would appear that as yet we do not know the complete history of this species, and it is possible that we may find that this insect has a double life-history similar to those of the "Hessian fly" or "Wheat-stem Maggot" (*Meromyza Americana*), which attack the young wheat plant at the root in the autumn, but in the stem during the summer. It is an important point to find out what its accurate life-history is, because until this is done it is useless for us to experiment for a complete remedy with any hope of success. In this connection the most important points are those which tell us how the wheat midge passes the winter. We have seen that some of the maggots leave the heads of the grain before the crop is cut and pass the winter beneath the ground, and that others remain between the scales of chaff and are carried with it to the barn or stack. By far the larger number are those which leave the heads of wheat before it is cut, and it is possible that if the crop were left standing long enough all would follow this course. It seems to me that this is the natural way for them to hibernate, from the fact that many of those which are carried with the grain dry up and do not come to maturity. Notwithstanding this, however, these little creatures have great powers of endurance, and although many are destroyed, a large proportion withstand this drying up, and, if left where the warmth and spring rains can get at them, will produce the perfect flies in due time. Not only will they endure a long period without moisture, but the opposite conditions of excessive moisture trouble them just as little. Indeed, Dr. Fitch speaks of them as amphibious. A moist, warm season in June is always more productive of midge injuries to wheat than a dry one, and their ravages are always more severe on low lying fields than upon uplands. As the greater number of maggots leave the grain as soon as it is ripe the advantage of cutting it, as soon as it possibly can be done without injury to the crop is manifest, for in this way a great many will be removed from the fields and can be destroyed at the time of threshing. This may be easily done, and is, I think, the remedy most to be relied on to reduce its ravages by artificial means. When the wheat is threshed the grubs are separated from the grain and are thrown down amongst the dust and rubbish which falls beneath the threshing machine, and are sometimes present in such numbers as to give a perceptible colour to this refuse. This should always be carefully swept up and burnt. If swept on one side and left till the following spring it will be merely a hotbed of mischief from which injury will be sown in every direction. In the annual report of the Entomologist and Botanist to the Director of the Dominion Experimental Farms for 1887, I made the following statement when suggesting remedies for this pest:—

"Under this heading I would first of all draw attention to the careless practice of farmers of not destroying the dust and rubbish from the threshing machine when they know their crop to have been infested with this insect. I have over and over again seen the ground beneath the machine coloured quite perceptibly by the pupæ which have remained in the ears when the crop was carried away.

"The greater part of these pupæ, although apparently much dried up, are yet in a condition to mature if left undisturbed on the ground. I would strongly recommend that the wise precaution taken by Nova Scotian farmers should be more widely adopted. Col. Blair, of Truro, N. S., tells me that it is the usual custom in Nova Scotia for good farmers to gather up all the rubbish from the threshing machines and take it out on to a cross-road or other hard ground and burn it. This is a means not only of destroying the larvae of the 'Weevil' and other insects, but also the seeds of pernicious weeds."

With regard to those which leave the ears of wheat before it is cut and pass the winter in the ground, cultivating the stubble directly the wheat is carried is recommended. This disturbs the grubs while they are going through their transformations and exposes them to the effects of the air and weather. It also lays them open to the attacks of

insectivorous birds and also to those of other insects which prey upon them. After a short time the land may be ploughed deeply so as to bury them so deep down that the flies will be unable to work their way up out of the ground.

In Miss E. A. Ormerod's "Manual of Injurious Insects and Methods of Prevention," a most excellent little work published in London, England, the following paragraph appears at page 81:—

"In Canada it is considered a complete cure to turn down the surface of the field with the Michigan plough, which, with the first turn-furrow, takes off about two inches of the surface, together with the weeds and stubble and the insect vermin in the roots, and deposits them at the bottom of the furrow, whilst the second turn-furrow raises another land slice, and, depositing it over the previous one, buries it several inches deep. If the course of agriculture allows this to be left untouched till after the usual time of appearance of the Wheat Midge in the following year it is found to completely destroy the maggot."

A remedy which has sometimes been attended with much success is to give up the sowing of fall wheats, which come into flower early, and sow instead spring wheat at such a time that it will not come into ear until after the midges have deposited their eggs. This they must do soon after they appear. With very little trouble and observation, the time of the appearance of the perfect midges in any one locality, can be discovered, and when this is known some variety of wheat must be chosen which does not come into ear at this period. Of the different varieties of fall wheat which are recommended for their immunity from the attacks of the midge "The Democrat" is one of the most highly esteemed, Mr. George Casey, M.P. for West Elgin, even going so far as to say that where this wheat has been grown in the same field with other varieties, it is exempt from attack whilst the others are destroyed. There are other varieties, varying in quality, which are more or less exempt from the attacks of this insect, but so far no first-class variety has been discovered. Many years ago, when the midge was very destructive in Canada, Mr. Arnold produced what was known as "Midge Proof Wheat." This was of poor quality, and he was undertaking a series of experiments in hybridizing it with better varieties when the attacks of the Midge ceased to be troublesome, and he carried the experiment no further. There is a "Midge Proof Wheat" grown in Nova Scotia by some farmers now, and Mr. James Clark, of Tatamagouche, N.S., who has now grown it for five years, finds it very satisfactory. He says, "it has given me the best satisfaction of any variety I ever had, never having been infested with either midge or rust, both of which are very common here. I know of no other variety which is altogether midge and rust proof."

The adoption of "Midge Proof Wheat," even if a variety of good quality could be produced, would not effect the total extermination of this pest by starving it out, for although it will by preference lay its eggs in wheat when it can be found in the proper condition; if this should not be available, it will lay and can pass all its stages in several of our native grasses, particularly "Couch Grass" (*Triticum repens*, L.), sometimes called "Twitch," "Quack," or "Skutch." This grass is botanically closely allied to the wheat plant. As the insect attacks grasses, it is clear that wherever they grow, around fields and in fence-corners, they should be cut down and all weeds kept under.