

TWENTIETH ANNUAL REPORT
OF THE
ENTOMOLOGICAL SOCIETY
OF
ONTARIO,
1889.

PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY.



TORONTO:
PRINTED BY WARWICK & SONS, 68 AND 70 FRONT STREET WEST.
1890.

595.7062
.F61

ENT

PRINT

PRINT

TWENTIETH ANNUAL REPORT
OF THE
ENTOMOLOGICAL SOCIETY
OF
ONTARIO,
1889.

PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY.



TORONTO:
PRINTED BY WARWICK & SONS, 68 & 70 FRONT STREET WEST.
1890.

Achroia grisella
Actias luna
Agassiz, Prof. Louis .
Agriculture and Arts
to
Agrilus ruficollis
Agrotis saucia
" scandens
" subgothica
Aletia argillacea
American Association
Advancement of
American lackey moth
" maple moth
Anisota senatoria
Annual Address of P
" Meeting of
Economic Entom
Annual Meeting of E
ciety of Ontario
Annual Report of Cou
" Statement of
Anonomcea laticlavata
Ants, caterpillars her
" how to get rid o
Apateta Americana
" oblivita
Aphomia colonella
Apple-tree, flat-head
" tent cater
Arhopalus fulminans
Arsenical insecticides,
bees
Arsenites, experiment
Association of Econ
gists
Attelabus bipustulatus
Australian bug on oran
Balavinus rectus
Bee-moths
Bethune, Rev. C. J. S
Bird murder in France
Blackbirds vs. Corn B
Bombycidae, notes on
Book Notice
Bot flies
Bowles, G. J., In Mer
Buprestis fasciata
Butterflies, a flock of .
" at Laggan,
" breeding fr
" catching w
" of Eastern
" of North A

TABLE OF CONTENTS.

	PAGE.		PAGE.
Achroia grisella.....	72	Calloides nobilis	57
Actias luna.....	48	Calosoma calidum.....	36
Agassiz, Prof. Louis.....	78	Camberwell-beauty butterfly	45
Agriculture and Arts Act, Amendment to	10, 16	<i>Canadian Entomologist</i>	11, 13
Agrilus ruficollis	51	Caterpillars herded by ants.....	93
Agrotis saucia	35	" stopping trains.....	86
" scandens	35	Catocala concumbens.....	50
" subgothica	35	" parta	50
Aletia argillacea.....	85	" ultronia.....	50
American Association for the Advancement of Science.....	21	Caulfield, F. B., article by.....	55
American lackey moth.....	82	Cephus integer	44
" maple moth.....	49	Chionobas Macounii, larva of	19
Anisota senatoria	64	Chrysobothris dentipes	58
Annual Address of President.....	2, 21	" femorata	58
" Meeting of Association of Economic Entomologists	29	Chrysomela Bigsbyana.....	52
Annual Meeting of Entomological So- ciety of Ontario.....	2	" spiræe	52
Annual Report of Council.....	10	Cicada septemdecim	62
" Statement of Secretary-Treas.	12	Cimbex Americana	43
Anonomæa laticlavata	52	Clarkson, F., article by	93
Ants, caterpillars herded by.....	93	Clisiocampa Americana	32, 49, 64, 81
" how to get rid of	90	" sylvatica	33, 64, 86
Apateta Americana.....	49	Clothes beetle, a new.....	41
" oblivita	49	Colaspis tristis.....	54
Aphomia colonella	73	Colorado potato-beetle.....	52
Apple-tree, flat-headed borer	58	Cook, Prof. A. J., article by	41
" tent caterpillars.....	32, 64	Cotalpa lavigera	51
Arhopalus fulminans	56	Cotton-worms, loss from	85
Arsenical insecticides, effect on honey bees	87	Cucumber beetle, remedy for.....	88
Arsenites, experiments with.....	30, 87, 88	Currant saw-fly, the imported	3, 36
Association of Economic Entomolo- gists.....	5, 22, 27, 29	Cut-worms	34
Attelabus bipustulatus.....	64	" climbing.....	35
Australian bug on orange-trees	3, 9	" remedies for.....	3, 26
Balavinus rectus	65	" the glassy.....	3
Bee-moths	71	Denton, S. W., articles by.....	91
Bethune, Rev. C. J. S., articles by..	85, 104	Diabrotica 12-punctata	54
Bird murder in France	89	" vittata	88
Blackbirds vs. Corn Boll-worms.....	89	Dicerca divaricata.....	51
Bombycidae, notes on	93	Disonycha alternata	53
Book Notice	104	" punctigera.....	53
Bot flies	68	Ecpantheria scribonia	48
Bowles, G. J., In Memoriam.....	20	Elaphidion villosum.....	60
Buprestis fasciata	51	Election of officers	15, 16, 27, 29
Butterflies, a flock of	91	Entomological Club, A. A. A. S.....	21
" at Laggan, Alta	7	Entozoic pests	69
" breeding from egg	7	Ephestia interpunctella.....	95
" catching with decoys.....	91	" kuhniella.....	96
" of Eastern United States.....	6	Eupsalis minuta	59
" of North America.....	6	Fasciola hepatica	70
		Fieri ground beetle.....	36
		Fitch, Dr. Asa	77
		Fletcher, J., articles by.....	31, 32, 34, 36, 38, 95
		Flour-moth, the Mediterranean.....	4, 22, 95
		Fluted-scale insect	9
		Forest tent-caterpillar	83, 64, 86

	PAGE.		PAGE.
Fyles, Rev. T. W., articles by	17, 66, 71, 74	Orchestes pallicornis	54
Galeruca decora	53	" rufipes	54
Galleria cereana	72, 73	Orgyia leucostigma	49, 81
Gall insects	32, 44	Ox bot-fly	68
Gapes in poultry	71	Pandeletejus hilaris	59
Goding, Dr. F. W., article by	20	Papilio turnus	38
Gothic dart moth	35	Parasites, importation of useful	9
Graptodera Chalybea	53	Phymatodes variabilis	60
Grasses injured by Thrips	22	" varius	60
Grote, A. R., article by	75	Plum-curculio, remedy for	88
Hadena arctica	3, 35	Practical Entomology, rise of, in	
" devastatrix	3	America	75
Hagen, Dr. H. A., article by	101	Priophorus æqualis	44
Harrington, W. H., article by	41	Report of Delegate to Royal Society	13
Harris, Dr. T. W	76	" Librarian	12
Hatch Experiment Stations	5	" Montreal Branch	15
Heat, effects of, on insects	17	Samia cecropia	47
Hepialidæ of the Province of Quebec	74	Saperda candida	52
Hepialus argenteo-maculatus	74	" moesta	56
" auratus	75	" mutica	52
" gracilis	75	Saunders: Insects Injurious to Fruits	104
" thule	75	Saw-flies	42
Hippobosca equina	67	Scelerostoma syngamus	71
Holcocera glanduella	65	Serica sericea	51
Hoplia trifasciata	51	Seventeen-year Cicada	62
Horn-fly	4	Sheep bot-fly	68
Horse bot-fly	68	" rot	70
" flies	66	" tick	68
" tick	67	Smerinthus excaecatus	46
Hylotrechus colonus	57	" geminatus	47
Hyperchiria Io	48	Sparrow destruction in Australia	90
Icerya purchasi	3, 9	Species, thoughts on determination of	83
Insect attacks in 1889	2, 22	Statistics of loss from insects	85
Insect Life	5	Strawberry saw-fly	43
Larch saw-fly	3, 25, 26, 38	Stomoxys calcitrans	67
Lasioderma serricorne	41	Tabanus atratus	67
Lepidoptera and nomenclature	16	" bovinis	67
Leptura zebra	60	" lineola	66, 67
Lepyrus geminatus	54	Tape-worms	69
Limenitis arthemis	46	Telea polyphemus	47
" disippus	46	Thalia univittata	63
Lina lapponica	54	Thrips, grass-eating	2, 8, 22
Liver fluke	70	Tiger swallow-tail butterfly	38
Live stock, creatures affecting	66	Toenia echinococcus	69
Locust carpenter-moth	55	" solium	69
Lucanus dama	51	Trichina spiralis	70
Magdalis olyra	59	Trichiosoma triangulum	43
Mediterranean flour-moth	4, 95	Urographis fasciatus	58
Melophagus ovinus	68	Vanessa Antiopa	45
Miscellaneous notes	85	Wheat midge	9, 26
Moffat, J. A., article by	83	Wild bees	42
Nematus Erichsonii	3, 25, 26, 38	Willows, insects infesting	41
" ribesii	3, 36	Winter collecting	31
Oak, insects injurious to the	55	Wylly, Mrs., article by	93
Edemasia concinna	49	Xylentes robinie	49, 55
Æneis jutta	7, 18	Zimmerman, Dr. Christian	101
" Macounii, breeding	7, 19		

ENT

To the Honorabl

SIR,—I hav
report of the En
of our Act of In

The annual
3rd of Septembe
the necessary bu
together with th

The Preside
included in the r
all who are intel

The Society
regularly issued
volume. It con
publication and
North America.

.....	PAGE.
.....	54
.....	54
.....	49, 81
.....	68
.....	59
.....	38
useful.....	9
.....	60
.....	60
r.....	88
rise of, in	75
.....	44
al Society..	13
.....	12
h.....	15
.....	47
.....	52
.....	56
.....	52
us to Fruits	104
.....	42
.....	71
.....	51
.....	62
.....	68
.....	70
.....	68
.....	46
.....	47
stralia.....	90
mination of	88
cts.....	85
.....	43
.....	67
.....	67
.....	67
.....	66, 67
.....	69
.....	47
.....	68
.....	2, 8, 22
.....	38
.....	69
.....	69
.....	70
.....	43
.....	58
.....	45
.....	9, 26
.....	42
.....	41
.....	31
.....	93
.....	49, 55
.....	101

TWENTIETH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO.

To the Honorable the Minister of Agriculture :

SIR,—I have the honor to submit for your approval the twentieth annual report of the Entomological Society of Ontario, in accordance with the provisions of our Act of Incorporation.

The annual meeting of the Society was held in the city of Toronto on the 3rd of September, 1889, when the officers for the ensuing year were elected and the necessary business of the Society was transacted. A report of the proceedings, together with the audited statement of finances, is herewith submitted.

The President's address and the papers on Economic and General Entomology included in the report, will be found, it is believed, of much interest and value by all who are intelligently engaged in farming or horticulture.

The Society's monthly magazine, *The Canadian Entomologist*, has been regularly issued during the past year, and has just completed its twenty-first volume. It continues to maintain its high reputation as a valuable scientific publication and to attract the contributions of the most eminent Entomologists of North America.

I have the honor 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 a lecture room of the new Biological Building of the University of Toronto on Tuesday, September 3rd, 1889. The President, Mr. James Fletcher, of Ottawa, took the chair at 11 o'clock a.m. The following members were present: Mr. E Baynes Reed and Mr. J. M. Denton, London; Mr. J. Alston Moffatt, Hamilton; Dr. Brodie, Dr. White, Masters O. and W. White, Mr. Gamble Geddes, Mr. A. Blue (Department of Agriculture), Toronto; Rev. C. J. S. Bethune, Port Hope; Mr. W. H. Harrington and Mr. R. Bell, Ottawa; Mr. H. H. Lyman, Montreal; Rev. T. W. Fyles, Quebec; Rev. W. R. Burman, Winnipeg; Mr. L. O. Howard, Assistant Entomologist, Department of Agriculture, Washington.

The minutes of the previous meeting having been printed and circulated among the members, the reading of them was dispensed with, and they were duly confirmed.

The President then delivered his annual address in which he referred especially to the chief insect attacks of the year.

ANNUAL ADDRESS OF THE PRESIDENT.

GENTLEMEN,—The present year has been one of great scientific interest in Canada. The event of greatest importance is, of course, the meeting of the American Association for the Advancement of Science, the participation in which we have just enjoyed. This has given us an opportunity of meeting personally many of the leading Entomologists of the country, who have long been known to all of us through their writings. The late deliberations of the entomological and botanical clubs have been of exceptional interest, and I feel proud that the members of our society should have taken so active a part in making these meetings successful.

Since I last had the honour of addressing you, the ravages of various kinds of injurious insects have demanded our attention. I will briefly draw your attention to some of these, so that there may be some discussion to-day upon the habits of the insects causing them, and thus what have been found to be the best remedies in the experience of those who have investigated them will be brought out. We discussed last year the injuries of the grass-eating thrips (*Phlæothrips poaphagus*). Continued observations during the past summer have shown that this insect is very widespread, and that although its attacks occasionally occur on other grasses, they are chiefly confined to June grass (*Poa pratensis*) early in June, and later in the month, to timothy (*Phleum pratense*). This attack is always most severe upon old meadows, and for the present the only remedy we can suggest is the ploughing up of those areas and laying them down to some other crop. Oats in central Ontario have been severely attacked by another yellowish species belonging to the Thripidæ. This insect has been submitted to Mr. Pergande, through the courtesy of the United States' Entomologist, and declared to be an undescribed species. The injury was perpetrated by the perforation and abortion of the oat flowers just before they left the sheath, by which they turned white,

and faded within the chaff of the infested fields, though the same, or a similar insect, is seen in the spring, seen cutting out worms. Fall (*Hadena devasta*) which attacks in grasses, upon the spring, the season of the caterpillars perfect moths of very abundant, and remedies for cutting. Keeping down all seem to be the best traps was tried especially in garden, which must Paris green and s out or appears at to the fact that very short distance be have been more of radishes and careful treatment of with a suggestion

The larch saw hood of Ottawa, swamps being re

The imported through the season to the unusual season the frequent rain it was put on.

During the present year, where I have been of Agriculture and this enjoyable visit magnificent collection kinds of machines

With regard to Agriculture, there of the entomologist have been undertaken the injurious *Aus* havoc in the orange been attended with introduced which Should nothing be important experin

and faded without coming to maturity. Later the insects were found beneath the chaff of the oats, from which they were eating the green matter. In badly infested fields, they could be shaken from the heads of grain in large numbers. The same, or a similar species, was also found in smaller numbers in wheat. During the spring, serious complaints were made in all quarters of the injuries by cutworms. Fall wheat was badly attacked by the larvæ of the glassy cutworm (*Hadena devastatrix*). This is a dirty white caterpillar with a bright red head, which attacks many kinds of plants, but particularly the different kinds of grasses, upon the roots of which they feed. Owing to the long, cool and damp spring, the season for these injurious caterpillars was very much protracted. Some of the caterpillars of different species being found as late as the end of July. The perfect moths of *Hadena devastatrix*, *H. artica* and *Agrotis clandestina* were very abundant, and flew right through the summer from July to October. As remedies for cutworms I have nothing to add to the suggestions I made last year. Keeping down all weeds in late summer and autumn, and late ploughing in autumn seem to be the best agricultural remedies. Of active remedies, the use of poisoned traps was tried carefully during the past season, and found very successful, particularly in gardens. These traps consist of loose bundles of any succulent vegetation, which must be tied together and then dropped into a strong mixture of Paris green and scattered over the land three or four days before the crop is planted out or appears above the ground. This remedy is sometimes condemned owing to the fact that when caterpillars have eaten the poisoned food they burrowed a short distance beneath the ground and died out of sight. Other insects which have been more or less injurious are the root maggots, which attacked onions, radishes and cabbages early in the season. I have received reports of the successful treatment of these insects with a solution of hellebore, and I mention it now with a suggestion that it should be tried by our members next spring.

The larch saw-fly (*Nematus Erichsonii*) was very abundant in the neighborhood of Ottawa, and in fresh districts in the Maritime Provinces; the tamarac swamps being rendered almost leafless for hundreds of acres.

The imported currant saw-fly (*Nematus ribesii*) was a troublesome pest right through the season until after the fruit was ripe. This was largely, I think, due to the unusual season, not only were some individuals of each brood retarded, but the frequent rains washed off the poison applied to the bushes almost as soon as it was put on.

During the past summer I had the great advantage of paying a visit to Washington, where I had the pleasure of meeting the entomologists of the Department of Agriculture and examining the working of the division of entomology. During this enjoyable visit I was treated with the greatest courtesy and hospitality. The magnificent collections were thrown open to me, and the working of the different kinds of machinery for checking the attacks of insects was explained.

With regard to the work of this important division of the Department of Agriculture, there are some experiments now being carried on under the direction of the entomologist which are of enormous importance to the country. These have been undertaken with the object of introducing the different parasites of the injurious Australian bug (*Icerya purchasi*), which is working such terrible havoc in the orange groves of California. By the latest advice these efforts have been attended with remarkable success, and a small coccinellid beetle has been introduced which is quickly clearing the orange trees of their pernicious parasites. Should nothing happen to change this state of affairs, this will be one of the most important experiments which has ever yet been tried in economic entomology.

The attacks of injurious insects in the United States are of course of great interest to us in Canada, not only on account of our own liability to suffer from the same species, but also from the benefits we derive directly from the labours and experience of the large staff of trained economic entomologists at work in the Union, who immediately investigate any new attack upon its first appearance. Although from time to time there occur serious outbreaks of injurious insects, most of these conform in their main characters to attacks which have already been studied carefully, and for which remedies based upon broad, general principles can be applied. Frequently, however, new pests appear and demand prompt action, but concerning the habits and treatment of which nothing is known. An outbreak of this nature which has not yet been observed in Canada, but which has lately attracted much attention in the agricultural press, is by a small fly, known as the Horn Fly, which is a fly belonging to the *Stomoxys* group of the *muscidae*. The mature insect, which is about half the size of the ordinary house fly, is very troublesome in worrying cattle in the pastures. The name of horn fly has been given to this insect on account of a habit exhibited early in the season of clustering in large numbers, when at rest, upon the horns of cattle, particularly at night. During a recent visit to Washington I had an opportunity of accompanying Mr. L. O. Howard upon an expedition into Virginia, to investigate the habits of this insect. We found it in large numbers upon cattle at Calverton, Virginia. The animals were considerably reduced owing to the attacks of their innumerable enemies, which worked their way down between the hairs and sucked their blood. The bite of these flies seems to cause much irritation, for some of the cattle had rubbed themselves against trees or licked themselves where bitten until they had large bare, or even raw spots, in some instances, of several inches in extent. Mr. Howard has succeeded in working out the complete life-history of this insect from the time the egg is laid upon freshly dropped cow-dung to maturity. He finds that the growth from the egg to the perfect insect is very rapid, only twelve days being required for it to pass through all its stages from the time the egg is laid. At page 60 in Vol. II. of "Insect Life," an account of the work of this insect is given, with the best remedies. These are: (1) thoroughly liming the droppings in places where cattle preferably stand at night, so as to kill off the larvæ, or (2) remedies for the protection of the animals from the attacks of the fly. Three applications for this purpose are suggested. (1) Fish oil and pine-tar with a little sulphur. (2) Tobacco dust when the skin is not broken. (3) Tallow and a small amount of carbolic acid. The last application, it is stated, will have a healing effect where sores have formed. This attack was first noticed on the coast in New Jersey, where it has been studied by Prof. J. B. Smith, who has found the tobacco dust the most successful remedy. From New Jersey the attack has gradually spread through Pennsylvania, Delaware, Maryland and North Virginia.

Another attack by an insect hitherto unknown on this continent, is a serious occurrence in Canada of the Mediterranean flour moth (*Ephestia Kühniella*), which was probably introduced from Europe in small numbers some two or three years ago, and being unnoticed has been allowed to increase to such an extent that one large mill has been actually obliged to shut down on account of the caterpillars spinning their webs in the machinery and infesting the produce. This outbreak of a serious pest which has been known to be the cause of much damage in Europe, has caused much apprehension lest it should spread to our large mills, and means are being taken in the city where the mill is located to stamp it out thoroughly. The only literature upon this subject which I have been able to find, is the last valuable report of our esteemed corresponding member, Miss E. A. Ormerod, who details some occurrences of the insect in mills in England. The means there adopted were, to clean and wash the mills as thoroughly as possible, and then to

subject every part that when the ca silken thread an disturbance was I have suggested as thoroughly as sene emulsion or and great care n those who have I believe, should danger in its use

Amongst the notice is demand from the divisor This magazine is Howard, and ow ing the informat opportunities the lication we have they may occur best remedies. nected with the apparatus gives, deal of useless tr menting in the s

A subject of tion of Econom of the American

The associat a year most of tl of the science, so and may hear of ences and discus efficient, simple injurious insects

The circums as follows: Wh this continent ha ticularly true of entomology has necessity.

The cause of passing, by the U This Act provide in the Union for there have alrea in various parts gists. There is stations will see effect of this me mologists scatter

subject every part of them which was accessible to a jet of steam. It was found that when the caterpillars were disturbed they would let themselves down by a silken thread and again return after the disturbance ceased, but that when the disturbance was of a moist nature, the silken thread was not made. The means I have suggested in Canada for stamping out this pest are, to brush down the mill as thoroughly as possible, and then subject every portion to a spraying of kerosene emulsion or gasoline. This latter is, of course, a very inflammable substance, and great care must be taken in its use; but judging from statements made by those who have used this liquid as an insecticide in similar instances, the results, I believe, should be satisfactory, and if proper care be taken, there should be no danger in its use.

Amongst the important aids to the work of the economic entomologist, special notice is demanded by that most useful publication, "Insect Life," which is issued from the division of entomology by the United States' Department of Agriculture. This magazine is under the able joint editorship of Messrs. C. V. Riley and L. O. Howard, and owes its great utility alike to the skill the editors exhibit in presenting the information they have to impart to their readers, as to the exceptional opportunities they have for obtaining it from authoritative sources. In this publication we have prompt notice of serious outbreaks of injurious insects wherever they may occur in the United States or Canada, and also suggestions as to the best remedies. We have, too, articles and monographs upon various subjects connected with the work of the entomologist. A series of articles upon spraying apparatus gives, in a concise form, much valuable information by which a great deal of useless trouble and expense will be saved to farmers and students experimenting in the selection and use of these necessary instruments.

A subject of particular interest to our members is the lately formed Association of Economic Entomologists, which was organized during the late meeting of the American Association for the Advancement of Science, in this city.

The association will, it is hoped, be a means of bringing together at least once a year most of the entomologists who study particularly the practical application of the science, so that they may become acquainted personally with each other, and may hear of the investigations which each is carrying on, to exchange experiences and discuss the best methods of work so as to obtain as quickly as possible efficient, simple and cheap remedies for controlling the operations of the many injurious insects whose attacks so materially reduce the revenue of the country.

The circumstances which led up to the formation of this association are briefly as follows: While it is true that the investigation of all the natural sciences on this continent has always had a more practical turn than in Europe, this is particularly true of entomological studies, and the literature of American economic entomology has now become so large as to make a bibliography an urgent necessity.

The cause of practical science has lately received a great impulse from the passing, by the United States Congress of the "Hatch Experiment Stations Act." This Act provides that an annual sum of \$15,000 shall be set aside for each State in the Union for the promotion of agricultural science. By virtue of this Act there have already been organized upwards of 60 government experiment stations in various parts of the Union, and of these no less than 27 have their entomologists. There is no doubt that before long the directors of many of the other stations will see the advisability of appointing entomologists on their staff. The effect of this measure will be, that there will be a large number of trained entomologists scattered over a large area, and all working at the same important

problem, of obtaining practical remedies for injurious insects—now whilst these men are all working independently, as a matter of course there must be a great duplication of work, and useless experimentation. The idea was promulgated that if an association were formed, by which economic entomologists would have an opportunity of meeting and discussing matters of mutual interest, that good results must follow. In the January number of "Insect Life," an editorial note appeared, asking for the opinion of entomologists upon this matter. Having thought the matter over carefully, I considered it of such importance that I made it the chief subject of my presidential address before the entomological club of the American Association, and begged the members to discuss whether the time were not ripe for the formation of a permanent organization. As a result of this appeal, the club resolved itself into a special committee and drew up and adopted a constitution and elected officers for the current year, as follows: President, Prof. Riley; Vice-President, Prof. Forbes; and as Secretary, Prof. J. B. Smith. This association is for all who make a specialty of economic entomology, and as constituted at present, consists of all who hold official positions as entomologists to governments, states or associations, or workers in practical entomology who may have applied for membership and been elected.

Several important publications on entomology have appeared during the past year. Mr. Scudder's magnificent work on the butterflies of the Northern United States and Canada is almost completed. The regularity with which the parts have been delivered to the subscribers upon the day of issue, has been a pleasing feature. The care shown in the preparation of the systematic work, and the large amount of new material given to the scientific world, makes this publication an important landmark in the study of diurnal lepidoptera. With regard to many of the points upon which Mr. Scudder was known to differ from the majority of entomologists, it must be acknowledged that his views have been put forth in an honest, straightforward manner, which has found him many adherents. No question of importance has been shirked or slurred over, but all are treated of fully and fairly, and we have no doubt that when the work is completed, Mr. Scudder will be ready to discuss with all who may wish to do so, any subjects, the clearing up of which will be of use to science. One of the valuable features of this work is the appendix, consisting of an article upon the parasites of butterflies. The hymenoptera are by Mr. L. O. Howard, Assistant United States Entomologist, and the diptera by Dr. Williston. It is not necessary to more than mention the names of these gentlemen to assure the quality of this part of the work.

Mr. W. H. Edwards continues to publish his superb "Butterflies of North America," and each succeeding part exceeds in value and excellence of the plates those which have preceded it. During the past year Mr. Edwards has continued his studies in breeding butterflies from the egg, with the most remarkable success. We trust that he may long be spared to carry on his valuable investigations, and give them to the world through the pages of the "Butterflies of North America." It may not be amiss, however, to remind entomologists that this is an extremely costly work to issue, and that the author has had to dispose of his large collections and a number of his books to enable him to continue the publication. I cannot help thinking that it is the duty of every entomologist who can afford to do so, to help this work to the extent of subscribing for it.

I have said that Mr. Edwards's success this year in breeding butterflies has been remarkable. This success has been largely contributed to by a gentleman in Canada, Mr. T. E. Bean, who has been living for some time at Laggan (Alta) in the Rocky Mountains. He is a most energetic collector and successful breeder

of insects. During the past year he has bred eggs of so many species that I consider it no exaggeration to say that he has passed through all the stages of butterfly life, from the egg to the adult. He has bred *Elis*, *Colias*, *Chryseis*, *Eneis*, *Jutta*, and many others, and has also added many of our ins-

Perhaps one of the most interesting specimens covered by Mr. Bean is a larva of *Elis* which will feed upon *Rhus*. Our last year's report mentioned a species of *Elis* that not only is a very closely allied species, but it is true it will feed upon *Rhus* apparently without any harm to me by Mr. Bean, but nothing but the

Another gentleman who has been breeding butterflies is Mr. Bean. He has sent Mr. Bean a number of larvæ bred from the mountains of Colorado. In the case of *Macounii*. Of several specimens raised a point of interest was raised the last week of the end of May. The time (the end of autumn) and once when I had a figure of a larva which has a grown larva. For a little, it is decided fact it has every thing of this life-history, and a nation. The only one of this genus, is thought to be laid at Quebec in the stages and hibernates the following year at Ottawa only a few miles west of West Virginia in a manner as the larva and then hibernates next year. This was sent by Mr. Bean as a species, which, if it is to be the case in our climate, many specimens in one year, there ta-

of insects. During the past summer he has sent to Mr. Edwards and myself the eggs of so many butterflies of exceptional rarity, and in such numbers, that I consider it no exaggeration to say that he has helped on the study of the preparatory stages of butterflies more than anyone else in Canada. Amongst the rare species of which eggs were sent by Mr. Bean, I will mention the following: *Colias Elis*, *Colias Christina*, *Colias Nastes*, *Colias Interior* (?), *Parnassius Smintheus*, *Eneis Jutta* and *Melitæa Anicia*. Mr. Bean's collections in the Rocky Mountains have also added largely to our knowledge of the geographical distribution of many of our insects of various orders.

Perhaps one of the most interesting points, scientifically, which has been discovered by Mr. Bean, is the positive knowledge that insects of the genus *Colias* will feed upon plants outside the order leguminosæ. I had myself suggested in our last year's report, from observing *Colias Interior* in nature, that they might feed upon species of *vaccinium* or "blue berry"; but Mr. Bean has discovered that not only is *vaccinium myrtifolius* the food-plant of *Colias Interior*, (or a closely allied species), but that *Colias Nastes* feeds naturally on willow, although it is true it will eat *Hedysarum boreale*, a leguminous plant. It eats this, however, apparently without relish, for of 15 young larvæ which hatched from eggs sent to me by Mr. Bean, only two fed on the *Hedysarum*, and this only after eating nothing but their egg shells for two days.

Another gentleman who has assisted materially in this interesting work of breeding butterflies, is Mr. David Bruce, who has spent the summer in Colorado. He has sent Mr. Edwards eggs of many rare species, and I have myself, at Ottawa larvæ bred from eggs that were sent by him inside letters from the mountain tops of Colorado. In our last report I referred to some experiments in breeding *Eneis Macounii*. Of several young larvæ which hatched from eggs collected at Nepigon, but one passed successfully through the winter; but this one, by its behaviour, raises a point of considerable interest. The perfect insect occurs at Nepigon in the last week of June, so that the caterpillars would probably pupate about the end of May. The specimen which I carried through the winter was only at that time (the end of May), half an inch in length, and had only moulted twice, once in autumn and once in spring. Full growth was not attained until the end of July, when I had a figure made, through the courtesy of the United States Entomologist, which has appeared in the pages of "Insect Life," with an account of the full grown larva. From that time until the present, although the caterpillar eats a little, it is decidedly getting smaller, is paler in colour, and is very sluggish—in fact it has every appearance of going into hibernation. An interesting feature of this life-history, as illustrated in this specimen, is the probability of a second hibernation. The only person as far as I know who has succeeded in breeding a species of this genus, is the Rev. T. W. Fyles, of Quebec, who bred *Eneis Jutta* from eggs laid at Quebec in the beginning of June. The larvæ passed through all their stages and hibernated full grown, and the perfect butterflies emerged in May of the following year. On the other hand, larvæ from eggs laid by the same species at Ottawa only a month later, both with Mr. Scudder at Boston and Mr. Edwards of West Virginia, as well as with me at Ottawa, behaved in exactly the same manner as the larvæ of *Oe. Macounii* from Nepigon, they passed only one moult and then hibernated in the second stage, and had all their growth to make the next year. This was also the case with larvæ from Rocky Mountain eggs of *Jutta* sent by Mr. Bean during the past summer. This points to a dual habit in the same species, which, if regular, is of great interest, and reminds one of what is known to be the case in the arctic regions where, probably on account of the uncertain climate, many species of genera which normally pass through all their stages in one year, there take two or even more before they arrive at maturity,

In the line of economic entomology, several reports, bulletins and papers have appeared since I last had the honour of addressing you, from the United States Entomologist, the State Entomologists of Illinois and New York, and from the various experimental stations and agricultural colleges in the United States.

Useful articles upon many insects which occur in Canada, have been issued officially in Indiana, Michigan, Nebraska, Ohio, South Carolina, New Jersey, Iowa and Kansas. These sources of information are, of course, of great interest to us, and we must be grateful for the frequent opportunities we have of benefitting from the experience of our friends to the south.

Before closing, I wish to bring one other subject under your notice for discussion. I have here some figures which have been executed direct from a photograph, which was taken at Ottawa by Mr. H. N. Topley, by the new isochromatic process, sent to New York and engraved by the Moss Engraving Co., and in less than a week the blocks were sent back to Ottawa ready for use. In this way great accuracy is assured without the much larger expense necessary when figures are drawn by an artist and then afterwards engraved. Figures are a great help in placing before our readers an intelligible idea of the insects we speak of in our reports; therefore it is an important consideration to get as many as possible, if they can be done accurately. Unluckily for natural history, such artists as Mrs. Comstock, Prof. Riley and his assistants, Miss Sullivan and Dr. Marx, are very scarce; but I am of the opinion that the process I have mentioned will, in a large measure, meet the difficulty under which we labour for the present.

And now, gentlemen, I beg to remind you that I have for three years presided over your deliberations. I trust that the influence and utility of the society may have increased during that time. It has been my endeavour to develop particularly the practical aspects of our studies, and I hope I may have succeeded in some measure; but I am strongly of the opinion that three years is long enough for any one person to hold the office of chief executive officer, and as the old adage "a new broom sweeps clean" is as true of entomology as of everything else, I must beg you, for the good of the society, to elect some one else to fill the important office of president for the ensuing year. I thank you all for your confidence, assistance and advice during my tenure of office, and beg you to allow me now to retire again to the ranks, where I shall always consider it an honour to work for and do my utmost to keep up the honorable position which has been won by the Entomological Society of Ontario.

Your obedient servant,

JAMES FLETCHER.

A cordial vote of thanks for his able and interesting address was unanimously voted to the president on motion of Dr. Bethune, seconded by Mr. Reed.

In the discussion which followed, Dr. Brodie stated that he had found several cereals injured by thrips; he discovered what were probably the larvæ of thrips feeding under the sheath on culms of grass, but when kept over night no specimens were to be found in the morning. He and Professor Wright had examined the insects and came to the conclusion that they were thrips. The larvæ were exceedingly difficult to mount for the microscope; if preserved in balsam they soon faded out and became useless, but better results followed the use of glycerine. He was satisfied that there are two broods in the year, the first being early in

the season. This places, and he found the rain set in, the

Mr. Geddes' common yellow large specimens found

Mr. Howard, the efforts of Dr. scale insect (*Icerya*). This noxious insect knew where. Entomologists did not then set to work. Australia. They found the insect in Australia, that it was Mr. Crawford. I found the insect. He then sent over to Los Angeles insect, and sent with the dipterous birds breeds most

As an instance planter, Colonel that his orchard afterwards wrote insect left. The referred to the (*Pieris rapae*).

Dr. Bethune years ago the par

Dr. Brodie w means of parasite poisons was a great the methods adopted the utmost.

Mr. Fletcher of poisons as remedies to use them until parasites at work away through an enemy. He had to procure the parasites unable to carry insects *Aspidiotus* never found one

Dr. Brodie adopted scientific a sweeping destruction midges some year

and papers have
the United States
rk, and from the
ited States.

have been issued
ew Jersey, Iowa
at interest to us,
ve of benefitting

ar notice for dis-
ct from a photo-
ew isochromatic
Co., and in less
se. In this way
ary when figures
are a great help
speak of in our
ny as possible, if
h artists as Mrs.
Marx, are very
d will, in a large
nt.

three years pre-
ity of the society
vour to develop
y have succeeded
ee years is long
fficer, and as the
as of everything
e else to fill the
all for your con-
you to allow me
it an honour to
which has been

LETCHER.

was unanimously
Reed.

ad found several
larvæ of thrips
might no speci-
t had examined
The larvæ were
in balsam they
use of glycerine.
st being early in

the season. This year, owing to dry weather, they were very abundant in waste places, and he found about one-half of the timothy destroyed by them. After the rain set in, the injury was very much reduced.

Mr. Geddes spoke of some variations in size that he had observed in the common yellow butterfly (*Colias philodice*), and expressed his opinion that the large specimens fed on clover, and the small on lucerne.

Mr. Howard, of Washington, gave an account of the success which has attended the efforts of Dr. Riley and his assistants to introduce parasites of the fluted-scale insect (*Icerya purchasi*, Maskell), a very destructive creature, in California. This noxious insect has appeared very suddenly in the State, from no one knew where. Experiments were made upon it, and remedies proposed, but the cultivators did not seem to care to make use of them on their plantations. They then set to work to learn its life-history, and soon found that it came from Australia. They corresponded with Mr. Frazer S. Crawford regarding it. He found the insect in Australia, but it was not at all abundant. They concluded, therefore, that it was kept in check by parasites. A dipterous parasite was found by Mr. Crawford. Their next proceeding was to send Mr. Koebele to Australia. He found the insect everywhere, and observed that it was very commonly parasitized. He then sent over about 15,000 living specimens of parasites. They were liberated at Los Angeles. He also found a lady-bird (*Vedalia*) feeding on the scale insect, and sent several thousand of them. The result has not been satisfactory with the dipterous parasite, as it breeds too slowly, but one of the species of lady-birds breeds most rapidly, and will no doubt keep the pest within due bounds.

As an instance of this, he mentioned that 400 lady-birds were sent to one planter, Colonel Dobbins, in May last; he thought from their satisfactory work that his orchard would be free from the pest by the close of the summer, but he afterwards wrote to say that on the 15th of August there was not one living scale insect left. The experiment had been entirely successful. Mr. Howard also referred to the importation of the parasites in 1883 of the cabbage-butterfly (*Pieris rapae*).

Dr. Bethune gave an account of his attempt to import from England many years ago the parasites of the wheat midge, and of the failure of the effort.

Dr. Brodie was strongly of opinion that noxious insects should be fought by means of parasites; that this was the true scientific method, and that the use of poisons was a grave mistake. He was very much gratified with the account of the methods adopted at Washington, and hoped that they would be developed to the utmost.

Mr. Fletcher in reply said that we could not possibly ignore the great value of poisons as remedies against noxious insects; that it was absolutely necessary to use them until we can depend upon the parasites; and that even if we had the parasites at work upon our destructive insects, they might at any time be swept away through a mildew or blight, and we should be left at the mercy of the enemy. He had been in correspondence with Mr. Whitehead in England in order to procure the parasites of *Diplosis*, but unfortunately this gentleman was ill and unable to carry out the project. He had found nearly all the specimens of scale insects *Aspidiotus* sent to him from British Columbia were parasitized, but had never found one affected in this way in Ontario.

Dr. Brodie thought that the farming community could never be brought to adopt scientific methods for the protection of their crops till they had suffered from a sweeping destruction. He referred, as an example, to the ravages of the wheat midge some years ago. In the county of York it wrought so much havoc that

the wheat fields were deserted and left to the cattle. A day's threshing would produce two bushels of midges and no grain. When their crops were all destroyed then they were willing to resort to remedies, chief among which were the employment of "midge-proof wheat" for seed, a judicious rotation of crops, and planting too early or too late to suit the habits of the midge. The introduction of new varieties of wheat was the principal means of getting rid of the pest. He wished that the farmers might lose all their potatoes, in order that they might be led by this severe lesson to give up the use of Paris green, and adopt scientific means of saving their crops.

After some further discussion, in the course of which the value of various poisons, such as arsenical preparations, hellebore, kerosene, etc., in checking insect ravages was insisted upon, the subject dropped.

Dr. White exhibited to the meeting some cheap wood-cuts in outline, of botanical subjects that were used in illustration of popular articles in "School Work and Play," and recommended that something similar should be done in order to popularize entomology. He said that specimens were first photographed upon zinc plates instead of glass, and in this way, by a special process, blocks were prepared for the printer at a very trifling expense. The project was heartily approved of, and it was agreed on all sides that much valuable instruction might be disseminated in this way.

Mr. Burman related his experience of injury to cattle and dogs by flies in the North-west, and asked whether fish-oil would be a remedy. In reply Mr. Fletcher and Mr. Howard stated that fish and other oils and greases were effective both in keeping off the flies and healing the affected parts.

The meeting then adjourned till the afternoon.

AFTERNOON SESSION.

The report of the council, the audited financial statement of the Secretary-Treasurer, and the report of the Librarian were presented and read to the meeting, and, on motion, were duly discussed and adopted.

REPORT OF THE COUNCIL.

The Council submit herewith their annual report.

The progress of the Society still continues, and the increased membership and the demand for materials for collections, evidences an encouraging activity among the workers in entomological pursuits, and affords good hope of satisfactory results.

During the year the Council found it necessary to obtain some alteration in the clauses of the Ontario Agriculture and Arts Act relating to the Entomological Society.

Through the kindness and courtesy of the Hon. the Minister of Agriculture the following amendment to the Act was passed:

"Section 67 of the said Act is amended by adding thereto, after sub-section (2), the following: 'Provided, however, that the Entomological Society of Ontario

shall, at its annual meeting, enumerate in Schedule A such five Divisional directors of the sa

The *Canadian Entomologist*, and maintain the same last year, papers of time to time as of as occasion require

The library has been provided. Some have been mentioned in the Report of the

Special reference to H. Scudder's "But at this date been i

In continuation of the Council has had to be rearranged.

In this connection the able services of Mr. and attention to t

The hearty thanks of Johnstone, also of donations of fresh

Through the Society has been i

Pursuant to the attend the meeting of Advancement of S Vice-President, M the *Canadian Entomologist* will be published

The Rev. Dr.

The report of herewith.

The accounts

Respectfully

shall, at its annual meeting, group into five divisions the Agricultural Divisions enumerated in Schedule A to this Act, and shall elect one person from each of such five Divisions (who shall be a resident of the Division he represents) as directors of the said Society."

The *Canadian Entomologist* is still published with regularity and promptness, and maintains its well-earned reputation. As intimated in the report of last year, papers on economic and popular entomology have been published from time to time as opportunity afforded, and it is intended to continue these papers as occasion requires.

The library has been well looked after, and further book case accommodation provided. Some 65 volumes have been added during the year, among them may be mentioned the final volumes of the *Encyclopædia Britannica* and 3 volumes of the Report of the Challenger.

Special reference must also be made to the splendid edition of Mr. S. H. Scudder's "Butterflies of New England and Canada," of which 10 numbers have at this date been issued and received.

In continuance of the work already begun during the previous year, the Council has had the Coleoptera carefully gone over and the drawers repapered and rearranged.

In this connection the Council desires to express its recognition of the valuable services of Mr. J. Alston Moffat, of Hamilton, Ont., who devoted much time and attention to this necessary work.

The hearty thanks of the Society are also due to Mr. Moffat, and Mr. J. Johnstone, also of Hamilton, and to other contributors, for many generous donations of fresh specimens for the cabinets of the Society.

Through the valuable assistance of Mr. W. H. Harrington, of Ottawa, the Society has been able to issue a revised list of Canadian Coleoptera.

Pursuant to established custom a deputation from the Society was sent to attend the meeting of the Entomological Club of the American Association for the Advancement of Science, held at Toronto. The President, Mr. Jas. Fletcher; the Vice-President, Mr. E. Baynes Reed, and the Rev. C. J. S. Bethune, the Editor of the *Canadian Entomologist*, attended the meeting. A report of the proceedings will be published in the columns of the *Entomologist*.

The Rev. Dr. Bethune was elected Vice-President of the Club.

The report of Mr. Lyman, the delegate to the Royal Society, is presented herewith.

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 TREASURER.

Receipts, 1888-9.

Membership Fees	\$239 19
Sales of <i>Entomologist</i>	63 19
Pins, cork, etc.	108 05
Advertisements	10 13
Government grant.....	1,000 00
Interest	5 38
Balance from last year	222 46
	\$1,648 40

Expenditure, 1888-9.

Printing	\$651 27
Report and meeting expenses	170 81
Library	141 56
Cabinet expenses	139 90
Expense account (postage, express and stationery)	52 32
Rent	80 00
Insurance	35 00
Grants to Editor, Secretary and Librarian.....	175 00
Cork, pins, etc	80 81
Balance	121 73
	\$1,648 40

REPORT OF LIBRARIAN AND ACTING CURATOR.

I submit herewith my report as Librarian and acting Curator of the Entomological Society for the year ending August 31, 1889.

The number of volumes now on the catalogue is 1,052, of which 65 were added during the year.

The volumes of the Encyclopædia Britannica have been completed, and the Report of the Challenger includes to date 20 volumes now in the library.

In accordance with the suggestion of the Council a new book case has been procured, and accommodation provided for some years to come.

The room has been papered, and the book cases stained, and store cases painted.

The books are in good order.

The cabinets of Coleoptera have been rearranged and the drawers repapered and much good work done by Mr. J. A. Moffat.

The *Canadian Entomologist* has been regularly issued and mailed.

Respectfully submitted.

E. BAYNES REED,
Librarian.

Mr. Moffat called which Mr. Reed has the excellent position of the Society before the Executive Committee showing in some part

Mr. Geddes, in warm terms to Mr. It was suggested it should be prepared of the library and

Mr. Denton said library, many of the merits of science. should be enabled that they might borrow

Dr. Brodie spoke made of all the library might very well be

Mr. Reed thought of the Society's library books in its different the hands of the library

Mr. Lyman read the report of the

REPORT

As delegate from to submit a brief report have much pleasure fostering care of the

The monthly journal able editorship of the account of the importance of the continent.

The volume for of reading matter, that of much interest. There were articles sent in from Florida in the east to California

Among the most on the preparatory histories of twelve several others.

The volume also new species of various

ER.

Mr. Moffat called attention to the large amount of work and the great care which Mr. Reed had bestowed upon the library during many years past, and of the excellent position into which it was now brought. He moved that "the thanks of the Society be given to Mr. Reed for his services in the library, and that the Executive Committee be hereby recommended to consider the possibility of shewing in some pecuniary way their recognition of his labours."

Mr. Geddes, in seconding the resolution, which was duly carried, referred in warm terms to Mr. Reed's efficiency and kindness in connection with the library. It was suggested in the discussion that followed, that a catalogue of the books should be prepared, and that by-laws should be framed for the proper regulation of the library and the issue of books to the members of the Society.

Mr. Denton said that there were now about eleven hundred volumes in the library, many of them being very rare works on entomology and other departments of science. He thought it most desirable that members out of London should be enabled to know what books there were and under what conditions they might borrow them.

Dr. Brodie spoke of the great importance of having a complete catalogue made of all the libraries in Ontario, and said that he considered it a work that might very well be undertaken by the Provincial Government.

Mr. Reed thought that we were still in too crude a state to publish a catalogue of the Society's library, but we might make a beginning by issuing lists of the books in its different departments. It was finally agreed to leave the matter in the hands of the librarian.

Mr. Lyman read his report as delegate to the Royal Society of Canada, and the report of the Montreal Branch of the Society.

REPORT TO THE ROYAL SOCIETY OF CANADA.

As delegate from the Entomological Society of Ontario, it is again my duty to submit a brief report of the work of the Society during the past year, and I have much pleasure in saying that the Society continues to prosper under the fostering care of the Government of Ontario.

The monthly journal of the Society, the *Canadian Entomologist*, under the able editorship of the Rev. Dr. Bethune, of Port Hope, first claims attention on account of the important position which it holds among the scientific publications of the continent.

The volume for 1888, which is the twentieth volume, consists of 240 pages of reading matter, the contributors numbering 33, and many of the articles being of much interest. In addition to those by our own Canadian members, there were articles sent in from active workers in 14 States of the American Union, from Florida in the south to Michigan in the north, and from Massachusetts in the east to California in the west.

Among the most important papers published in the volume were a number on the preparatory stages of the various insects, including the complete life histories of twelve species of lepidoptera, besides partial descriptions of those of several others.

The volume also contains the descriptions of four new genera and fifty-six new species of various orders.

\$239 19
63 19
108 05
10 13
1,000 00
5 38
222 46

\$1,648 40

\$651 27
170 81
141 56
139 90
52 32
80 00
35 00
175 00
80 81
121 73

\$1,648 40

ATOR.

rator of the Ento-

of which 65 were

ompleted, and the
e library.

ook case has been

, and store cases

rawers repapered

mailed.

REED,
Librarian.

In the 21st volume now publishing, there is appearing a series of papers upon "Popular and Economic Entomology," which the Council believe will be of value to the fruit growers, farmers and gardeners of the country.

The annual report of the Society to the Minister of Agriculture of Ontario, for 1888, has been published, and contains, in addition to the usual report of the annual meeting of the Society, many interesting papers. One of the most important of these is the account by our President, Mr. Fletcher, of his last year's trip to Nepigon, whither he went for a week at the beginning of July, accompanied by Mr. S. H. Scudder, an associate member of the Society, and one of the most eminent entomologists of America, for the express purpose of obtaining the eggs of various species of butterflies. The expedition was very successful, eggs being obtained from no less than seventeen species and varieties.

At the annual meeting of the Society it was found that the finances were in such a satisfactory state as to render possible the voting of the handsome sum of \$200 to the library fund for the purchase of books and the binding of periodicals and pamphlets.

The library now contains upwards of a thousand volumes, chiefly on entomology, but also many on the other departments of Zoology and on Botany.

An important move has recently been made in opening the rooms of the Society to visitors at regular stated times in order to popularize the work of the Society as much as possible.

The Society's collections of coleoptera and lepidoptera have been carefully rearranged during the year by Mr. J. Alston Moffat, of Hamilton, a member of the Council, and now form standard reference collections of these insects of Ontario.

The Montreal branch, I am happy to say, continues in active existence, Regular monthly meetings are held, and increased interest is being taken in the study of this science.

During the past year great activity has also been shown by many of the associate members of the Society, and several very important and useful works have been issued by them. The most important of these is Mr. Scudder's sumptuous work on "The Butterflies of the Eastern United States and Canada, with special reference to New England," the first part of which was issued on November 1st, and will be completed during the year.

Mr. W. H. Edwards is also carrying on his magnificent work on the "Butterflies of North America." Three parts, containing nine beautiful plates, were issued during last year.

Several works of a very different scope from either of the above, but still very useful, and issued at a moderate price, have been published by other associate members of our society during the past year.

Among these, special mention should be made of "Entomology for beginners, for the use of young folks, fruit-growers, farmers and gardeners," by Dr. A. S. Packard, and "An Introduction to Entomology," part I, by Prof. J. H. Comstock.

A second edition of Mr. William Saunders' important work on "Insects injurious to fruits" has also been issued.

H. H. LYMAN,
Delegate.

MONTREAL

The sixteenth
1889, at 8 o'clock,
The President

SIXTEENTH ANN

The Council
pleasure in recordi
the last annual me

During the ye
were read:—

1. List of But
2. The Butter
3. Notes on th
Trenholme.

4. Historical S
5. Notes on H

The members
parent society at
species of the genu

During the ye

The President
delegate to the Ro
tinguished body on

In conclusion
in the study of the
but to study their
this department an

Submitted on

The Secretary

The reports ha
ensuing year:—Pre
tary-Treasurer, E. C

The President
pertius, *Pamphila*
Lycæna neglecta (p
Nepigon.

Mr. Winn repor
bers during the spr

MONTREAL BRANCH OF THE ENTOMOLOGICAL SOCIETY OF
ONTARIO.

The sixteenth annual meeting of the Montreal Branch was held on May 15th 1889, at 8 o'clock, p.m.

The President read the following report of the Council for the year:—

SIXTEENTH ANNUAL REPORT OF THE MONTREAL BRANCH OF THE ENTOMO-
LOGICAL SOCIETY OF ONTARIO.

The Council in submitting their report for the year 1888-89, have much pleasure in recording a decided improvement in the condition of the Branch since the last annual meeting.

During the year eight meetings have been held at which the following papers were read:—

1. List of Butterflies taken at Cap à l'Aigle, P. Q.—E. C. Trenholme.
2. The Butterflies of Northern British America.—H. H. Lyman.
3. Notes on the forms of *Lycæna pseudargiolus* found at Montreal.—E. C. Trenholme.
4. Historical Sketch of the Montreal Branch.—H. H. Lyman.
5. Notes on Hipparchia or Satyrus.—H. H. Lyman.

The members had the pleasure of the attendance of the President of the parent society at the March meeting, at which an interesting discussion on the species of the genus *Pamphila* took place.

During the year one member, Mr. Albert Holden, has resigned.

The President of the Branch had the honour of being elected the Society's delegate to the Royal Society of Canada, and attended the meeting of that distinguished body on May 7th of the present year.

In conclusion the Council would again urge the members to greater activity in the study of the science; not to be merely collectors of these beautiful forms, but to study their habits and life-histories, as much still remains to be done in this department and the work, though requiring patient care, is most interesting.

Submitted on behalf of the Council.

H. H. LYMAN,
President.

The Secretary-Treasurer submitted the financial report.

The reports having been adopted, 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 President showed specimens of *Cænonympha ampelos*, *Nisoniades propretius*, *Pamphila agricola*, and *Halisidota sobrina*, from Victoria, B. C. *Lycæna neglecta* (pupa) from Vancouver Island, and *Nemeophila Selwynii* from Nepigon.

Mr. Winn reported that *Pieris napi oleracea* had been taken in some numbers during the spring and *Brephos infans* seen.

E. C. TRENHOLME,
Secretary-Treasurer.

LYMAN,
Delegate.

Mr. Reed in reply to an enquiry gave an account of what had been done during the past year with regard to the Society's rooms and collections; he stated that they had frequently been opened to the public, and that many very pleasant evenings had been spent among the microscopes, books and cabinets.

DIVISION GROUPS.

Mr. Reed drew the attention of the meeting to the changes in "The Agriculture and Arts Act" affecting the Society made during the last session of the Ontario Legislature, and moved, seconded by Dr. Bethune, "That in accordance with the provisions of section 67 of the Agriculture and Arts Act as amended in 1889, the agricultural divisions in Schedule A of the said Act be grouped into the following five divisions for the purpose of electing one person from each of such five divisions (who shall be a resident of the district he represents) as directors of the Entomological Society of Ontario:—

Division 1 to comprise Agricultural Divisions	1,	2,	3.
"	2	"	"
"	3	"	"
"	4	"	"
"	5	"	"
			4, 5, 13.
			6, 10.
			7, 8, 9.
			11, 12.

and that this grouping of the divisions be in force until otherwise altered or re-arranged at any annual meeting of the Society."—*Carried.*

ELECTION OF OFFICERS.

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

President, Rev. C. J. S. Bethune, M. A., D.C.L., Port Hope; Vice-President, E. Baynes Reed, London; Secretary-Treasurer, W. E. Saunders, London; Librarian, E. Baynes Reed, London; Curator, Rowland Hill, London;

Directors, Division 1.—W. H. Harrington, Ottawa.
 " 2.—J. D. Evans, Sudbury.
 " 3.—Gamble Geddes, Toronto.
 " 4.—J. Alston Moffat, Hamilton.
 " 5.—J. M. Denton, London.

Editor of the *Canadian Entomologist*, Rev. Dr. Bethune, Port Hope; Editing Committee, James Fletcher, Ottawa; J. M. Denton, London; Rev. T. W. Fyles, Quebec; Dr. Brodie, Toronto; Delegate to the Royal Society of Canada, H. H. Lyman, Montreal; Auditors, J. M. Denton and E. B. Reed.

LEPIDOPTERA AND NOMENCLATURE.

Mr. Moffat, who has been engaged for some time past in rearranging the Society's collections, spoke of the desirability of printing a new list of lepidoptera for labelling purposes.

Dr. Bethune said that he did not think it advisable to do so just now as the nomenclature of the order must be considered to be in a somewhat transition state; he thought that after Mr. Scudder's magnificent work on the butterflies was completed, and students had time to master its contents, there would be

a very general a
 would alter very
 Smith's contemp
 new species by M
Micros, as render
 he had in his po
 publication was
 that Mr. Moffat'
 lists published a

Dr. Brodie g
 of the habits and
 and labour for m

EFF

The Rev. T.

Our attentio
 and others, to th
 to stage of their e
 remarkable. La
 creeper (*Ampelo*
 the time being, a
 been carefully ex
 larvæ were min
 placed the jar o
 On the last day
 dry oak leaves in
 Nessus; and a fu
 been kept at an
 day.

On the fir
 presented itself.
 and, to please hi

No doubt m
 hibernating spec
 untimely by heat
 lids having rema

Those who l
 observed, that, i
 warmth of the h
 proper food plan
 place in them, by
 they might feed
 have been suppor

a very general adoption of many, at any rate, of his generic titles, and that this would alter very much our current nomenclature. He also referred to Prof. J. B. Smith's contemplated monograph of the *Noctuidæ*, the frequent descriptions of new species by Mr. Hulst and others, and the work of Prof. Fernald among the *Micros*, as rendering the publication of a list premature at present. He said that he had in his possession a new check-list of the *Noctuidæ* by Mr. Grote, but its publication was deemed unwise owing to the foregoing considerations. He thought that Mr. Moffat's object could be met by printing a few sheets to supplement the lists published a few years ago by Dr. Brodie and Dr. White.

GALL INSECTS.

Dr. Brodie gave a very interesting account of his studies and investigations of the habits and life-history of gall insects, to which he has devoted much time and labour for many years past.

EFFECTS OF HEAT UPON INSECT LIFE.

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

The Rev. T. W. Fyles read a paper on the "Effects of Heat upon Insect Life."

Our attention has been drawn by that accurate observer, Mr. W. H. Edwards, and others, to the effects of cold in retarding the developement of insects from stage to stage of their existence. The effects of heat in hastening their changes are no less remarkable. Last autumn I found caterpillars of *Amphion nessus* upon Virginia creeper (*Ampelopsis quinquefolia*). They were full fed; and I placed them (for the time being, as I thought) in a glass jar, partly filled with fresh earth that had been carefully examined, and containing oak leaves in which some, to me, unknown larvæ were mining. These latter I hoped to raise. Failing in my efforts, I placed the jar on a shelf in my study, quite forgetting the *Nessus* caterpillars. On the last day of December my attention was arrested by the rustling of the dry oak leaves in the jar. On examination I found a newly developed imago of *Nessus*; and a further search revealed a second crippled and dead. My room had been kept at an equal temperature—the fire having been maintained night and day.

On the first of January, in the same room, a specimen of *Papilio asterias* presented itself. A neighbour's son had brought the chrysalis some months before, and, to please him, I had fastened it by its silken attachment to the window frame.

No doubt many butterflies that present themselves at times in the winter are hibernating species; but this instance shews that summer forms may be developed untimely by heat. *Pieris rapæ* is often seen in houses in mid winter, the chrysalids having remained unnoticed in neglected corners.

Those who have had much experience in raising insects will no doubt have observed, that, in instances of species that spend the winter in the egg, the warmth of the house sometimes causes the eggs to hatch before the leaves of the proper food plant have appeared. I have often had to open the leaf buds, and to place in them, by means of a camel's hair pencil, the newly hatched larvæ, that they might feed upon the undeveloped leaflets. Through this expedient they have been supported till the foliage was more advanced.

The invigorating effects of warmth upon hibernating insects have often been noticed. In England, in sheltered woodland nooks, on unusually bright days, even as late as November, I have seen *Grapta comma* disporting itself. We had some remarkably fine weather in Quebec province early in the present year, and, on the 5th of April, I captured at Magog a female specimen of *Grapta J-album*. I brought it alive to Quebec hoping to obtain eggs from it; but, after keeping it for some time, I came to the conclusion that it had not been fertilized. Mr. Caulfield, mentions, in Can. Ent. Vol. IX., page 40, that he saw a pair of this species *in coitu* as late as April 26th.

In parts of the country where the land lies open to the south for any considerable distance, and where warm winds prevail, insect forms are found far from their usual habitats. From Chateauguay near the valley of Lake Champlain and the Hudson, Mr. Jack has recorded the capture of *Papilio chresphontes* and *Euptoieta Claudia* (Can. Ent. Vol. XIV, p. 219). And in the Niagara district, near the extremity of the broad Mississippi valley, many southern insects have been taken.

Hitherto we have noticed the effects of heat in hastening the development of immature insects and in invigorating those that have reached perfection; but we must not forget to notice that heat intensified soon becomes fatal to insect life.

The 22nd of March of the present year was unusually bright and warm, though the snow still covered the ground. I was on a visit at Melbourne, Province of Quebec. Tempted by the warmth, I took a chair and sat in the sunshine on the verandah of the house at which I was staying. Looking up, I saw in the shadow of the roof a number of water flies of the species *Perla nivicola* (Fitch). Presently one of these fluttered down, and alit in the glare of the sunshine. In a moment or two it exhibited signs of the utmost distress. It hurried hither and thither, whirled around as if seized with vertigo, then curled up, and died. Soon another of the insects descended, and, after vainly endeavouring to find shelter in a crevice, succumbed in the same way. I looked round and found a number of the dead flies, all lying where the sun struck with greatest power. The circumstance reminded me of the occasion of my first acquaintance with *Nematus Ericksonii* in its perfect state. In 1883 I had seen the larvæ in great numbers in the border townships Bury, Lingwick, etc. In 1884, on an intensely hot summer's day, I was crossing to Quebec in the Levis ferry-boat. The deck was like the floor of an oven; and scattered over it were numbers of the saw-flies. Migrating and weary, they had been tempted to alight, and had been overpowered by the heat, and literally roasted.

We all know that, on bright "field-days," the morning before the sun has gained its strength, and the afternoon, when it is on the decline, are the times for finding diurnal insects on the wing. They seem to avoid exposure to the sun in its meridian splendour.

I have been testing the degree of heat that the potato beetle *Doryphora decem-lineata* can bear; and I find that water heated to 114° (96 degrees below boiling point) will kill them.

Boreal forms of insect life are met with in isolated spots in which the climatic influences are exceptional. For instance, *Chionobas semidea* is found on the summit of Mount Washington and nowhere else in a radius of many hundred miles.

Mr. Scudder has given us valuable information concerning the effects of heat upon *Semidea*. He tells us that the insect "cannot bear transportation so much as 3,000 feet vertically to the base of the steeper slopes, at least if this transportation is effected in a rapid manner."

In a swamp, not far from Quebec, near the point where the great northern plateau begins to recede from the river, *C. Jutta* may be met with. There are similar swamps on the south side of the St. Lawrence; but I have never heard that *Jutta* has been found in them.

Chionobas Macc may be safely exp. but I lost the lar. too mild for them. others, so I give n. Beutenmüller up. agree with my de Mr. Beutenmüller

Newly Hatch marked transverse on each side of the lines dark-amber. each segment. Moulded August 1

Larva after having six longitu dorsal lines cinnai Moulded Septemb

Larva after with a faint purpl warts on each sid intervals a chocola lighter shade of first and last on sluggish, refused t

Doubtless ma might be accumul them.

Mr. Harring good deal of eff levels, as well as of extreme heat, and *Conotrachel* and that when tl of its rays; he h roof from this cr

Mr. Fletche *Macounii* which obtained last yea eggs is given in t in their second st protection. In thermometer fell about four feet o

The Rev. W After spendi mens brought b London, Ontario.

Chionobas Macounii, it would seem, cannot bear the degree of temperature that Jutta may be safely exposed to. Mr. Fletcher sent me eggs of the species, and they hatched, but I lost the larva after the second moult. The weather at Quebec was, I presume, too mild for them. However, the larvæ seemed to have survived longer with me than with others, so I give my notes upon them. And here I would observe that the notes of Mr. Beutenmüller upon the young larva, in the *Canadian Entomologist* for August last, agree with my description of it *after the first moult*. The first moult probably escaped Mr. Beutenmüller's observation.

NOTES ON CHIONOBAS MACOUNII.

Newly Hatched Larva.—One-tenth inch long. *Head*, large, honey-yellow, indented, marked transversely with two rows of light brown spots. Several dark brown warts on each side of the head. *Body*, bluish white; dorsal, sub-dorsal, side, and spiracular lines dark-amber. Two dots of the same colour, one on each side of the dorsal line, in each segment. Anal projections. *Spiracles*, dark amber. *Legs*, semi-transparent. Moulded August 13th.

Larva after 1st Moult.—Two-tenths of an inch long. *Head* whitish, indented, having six longitudinal rows of pale brown dots. *Body* cream-white; dorsal and sub-dorsal lines cinnamon; side lines brown; spiracular line pale cinnamon; spiracles black. Moulded September 3rd.

Larva after 2nd Moult.—Length one-quarter of an inch. *Head* indented, whitish with a faint purple tinge, retains the six longitudinal rows of brown dots. Six black warts on each side. *Body* cream-coloured; dorsal line amber, then at both sides at intervals a chocolate line, an amber line, and again a chocolate line. Spiracular line a lighter shade of chocolate. A similar line just above the legs. Spiracles black, the first and last on each side larger than the rest. After this moult the insect became sluggish, refused to eat, and gradually withered away.

Doubtless many interesting particulars of the effects of heat upon the insect life might be accumulated if entomologists would record their observations in regard to them.

Mr. Harrington thought that the difference of atmospheric pressure had a good deal of effect upon insects brought down from high altitudes to the lower levels, as well as the change of temperature. As an instance of the fatal effects of extreme heat, he mentioned that he had found the snout beetles *Pissodes strobi* and *Conotrachelus nenuphar* in quantities upon a zinc roof at Ottawa in summer, and that when the sun got round to them they were usually all killed by the heat of its rays; he had found as much as a quart of these beetles in a corner of the roof from this cause.

Mr. Fletcher mentioned that he had had some caterpillars of *Chionobas Macounii* which had attained their full growth. They were reared from eggs obtained last year at Nepigon (a full account of the expedition in search of these eggs is given in the Annual Report for 1888, page 85). The caterpillars hibernated in their second stage, passing the winter out of doors on sedges entirely without protection. In the early part of the winter the cold was very severe and the thermometer fell to 20° below zero; afterwards the caterpillars were covered with about four feet of snow.

The Rev. W. A. Burman, of Winnipeg, was elected a member of the Society. After spending some time in the examination and discussion of various specimens brought by members, the meeting adjourned to meet again next year in London, Ontario.

IN MEMORIAM : GEORGE JOHN BOWLES.

By F. W. Goding, M.D.

The recent death of Mr. Bowles has called forth expressions of regret from every quarter, and is considered by all who were so fortunate as to name him among their friends as a national loss. The Council of the Ontario Entomological Society, referring to his death, said: "They have to deplore the loss they have recently sustained by the lamented death of their colleague, Mr. G. J. Bowles, of Montreal, who was for many years an active and zealous member of the Society, an able and efficient worker, and a valued contributor to the magazine and annual reports."

George John Bowles was born in Quebec, June 14th, 1837, and was the eldest son of Mr. John Bowles, a tradesman of that city, and his wife Margaret Cochrane; a worthy couple still living at a ripe age at Brighton, Ontario.

In 1844 the family removed to Three Rivers, in the Province of Quebec, where they resided for seven years, returning to Quebec in 1851. During this period George received his only school education, finishing it by a course of study at the Three Rivers academy. Soon after returning to Quebec he began to earn his own living by entering the Quebec Provident and Savings Bank as clerk, a situation he held for nineteen years, rising at last to the post of assistant cashier. In the early part of this period the advantages of a collegiate education were not available in Quebec for residents, the Morin College being not then in existence, and although the boy's inclinations always lay in that direction, they could not be gratified. He was a great reader, however, and by dint of application amassed an amount of information, Biblical, historical and scientific, which was a "well of pleasure" to him ever afterward. His short business hours, and a residence for several years some miles from the city, greatly favored his love of nature; rambles through the woods in the vicinity soon made him acquainted with the birds, insects and plants to be found there, "and a walk of five miles, almost daily, to town through charming scenery of the old city of Quebec, was a pleasant task."

In 1863 Mr. Bowles began to direct his attention more particularly to entomology. At that time Mr. Wm. Couper, a well-known Canadian naturalist, lived in Quebec, and to him Mr. Bowles came for assistance, which was cheerfully given him at all times. The capture of a specimen of *Pieris rapae* then lately introduced from Europe and beginning to be abundant about him, was one of the causes which induced him to take up entomology as a specialty. His first contribution to scientific literature was on this subject, and was published the following year. But his scientific studies were directed chiefly by Prof. Wm. Saunders, who gave him every help throughout his entomological career. His spare time between the years 1863 and 1872 was spent in collecting the Lepidoptera of the vicinity of Quebec, and studying the injurious insects of that locality, publishing carefully prepared papers, chiefly in the *Canadian Entomologist*, the *Canadian Naturalist and Geologist*, and the Montreal Horticultural Society's reports.

In 1872 Mr. Bowles removed to Montreal to become secretary-treasurer of the British American Bank-note Company, a position he held till his death. Although engaged continuously for more than twenty-five years in business affairs of a most exacting nature, he studied during his leisure hours the insects of his native Province of Quebec, and endeavored to advance and popularize our knowledge of them. That he was eminently successful is well-known to all interested in the agriculture of Canada. The principal part of his work was done by private correspondence, which, if collected and published, would be a fitting monument to his industry.

He was for several years president of the Montreal branch of this Society, holding that position at the time of his death. He was an honored member of the following:—Montreal Natural History Society, Montreal Microscopical Society, American Association for the Advancement of Science, and the New York Entomological Society, to whose meetings he contributed occasional papers.

Mr. Bowles was married in 1861 to Miss Elizabeth Patterson, orphan daughter of

an officer in the Biological cabinet repository of the McGill University.

Mr. Bowles was always a diligent worker, and his life has been filled, however, with

PROCEEDINGS
ASSOCIATION

For the first time in this Province, a meeting was held on August, 1889. The following gentlemen were present during the day: Dr. T. J. B. Burge, Fernow, Washington; Hargill, Oxford, O.; Lyman, Montreal; Smith, New Brunswick; Columbus, Ohio; and

The meeting was delivered the following

ANNUAL ADDRESS

GENTLEMEN.—in the city of Cleveland, faces of several of which has been satirically grateful to such of certain extent, you largely responsible papers to be read at the most of the papers an address at the meeting and shall endeavor to me are worthy generally take the which the society the other hand, the purpose following some of the most recent during the period of your attention to certain seems to me can be

When last year I was elected, in selecting me, the first position as tendered in recognition of the good work done together with Dr. J.

an officer in the British Army, and has left a son and two daughters. His large entomological cabinet representing all orders of insects, has been transferred to the museum of the McGill University.

Mr. Bowles was inclined to be quiet and unassuming in his habits and manners; he was always a diligent student and an honest observer. In a letter to the writer he said: "My life has been so uneventful that there is but little of interest in it. It has been filled, however, with steady, quiet work."

PROCEEDINGS OF THE ENTOMOLOGICAL CLUB OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

For the first time in its history the American Association held its annual meeting in this Province, and assembled in the University Buildings, Toronto, on the 28th of August, 1889. The Entomological Club began its regular sessions in the afternoon of that day in the rooms of the new Biological Department of the Toronto University. There were present during the meetings:—Rev. C. J. S. Bethune, Port Hope; W. A. Bowman, Dr. T. J. B. Burgess, Hamilton; Prof. A. J. Cook, Agricultural College, Mich.; B. E. Fernow, Washington, D.C.; J. Fletcher, Ottawa; H. Garman, Lexington, Ky.; C. W. Hargill, Oxford, Ohio; L. O. Howard, Washington, D.C.; Dr. Hoy, Racine, Wis.; H. H. Lyman, Montreal; J. J. Mackenzie, Toronto; Prof. W. Saunders, Ottawa; Prof. J. B. Smith, New Brunswick, N.J.; E. P. Thompson, Beaver Falls, Pa.; Clarence M. Weed, Columbus, Ohio; Rev. L. C. Wurtele, Acton Vale, P.Q.

The meeting was called to order by the President, Mr. James Fletcher, who then delivered the following annual address:—

ANNUAL ADDRESS OF THE PRESIDENT OF THE ENTOMOLOGICAL CLUB OF THE A. A. A. S., 1889.

GENTLEMEN.—Another year has rolled by since we held our last pleasant meeting in the city of Cleveland. It is with much pleasure that I recognise here to-day the faces of several of those who helped to make that meeting so successful, and, as gratitude has been satirically described as "a keen appreciation of further favours to come," I feel grateful to such of you for being present at this meeting, the success of which, to a certain extent, your presence assures; but for which I, as presiding officer, shall be held largely responsible. With the help of our Secretary I have endeavored to arrange the papers to be read so as to save as much time as possible, and at the same time to make the most of the papers. It is a time-honoured custom that the President should give an address at the opening of the annual session, I therefore bow to the decree of fate, and shall endeavor for a short time to lay before you some subjects which it has occurred to me are worthy of consideration by the members of the club. Inaugural addresses generally take the form either of a prospective or retrospective view of the matters with which the society before which they are delivered particularly concerns itself; or, on the other hand, they are devoted to the elaboration of some one special subject. I purpose following the former of these courses to-day, and shall briefly remind you of some of the most remarkable occurrences affecting entomologists which have taken place during the period which has elapsed since we last met, and I shall also endeavor to direct your attention to one special matter connected with the future of the science which it seems to me can be discussed to advantage during the present meeting.

When last year you conferred upon me what I felt was the too great honour of electing me, the first Canadian, to fill the chair of the Entomologists' Club, I accepted that position as tendered to the President of the Entomological Society of Ontario, in recognition of the good work which has been done by that Society, which I, on that occasion, together with Dr. Bethune, had the honour of representing as delegate.

The chief attacks by insects upon cultivated crops which have demanded the attention of entomologists during the past season are the following:—In all parts of Canada and the United States the noctuid larvae known under the name of "Outworms" were extremely abundant in the spring. In the Maritime Provinces of New Brunswick and Nova Scotia, as well as Quebec, the Tent Caterpillar did much injury to orchard and forest trees. In Central Ontario *Meromyza Americana* was unusually abundant, but it was also accompanied by its parasite *Coelinius Meromyzæ*. Not only were certain kinds of wheat and barley severely attacked, but also a single instance of the attack on oats was observed, and I made the further unpleasant discovery that the species bred freely in various wild grasses, chiefly of the Genera *Agropyrum*, *Deschampsia*, *Elymus* and *Poa*. Upon the experimental grass patches of the Experimental Farm at Ottawa the species of *Agropyrum* and *Elymus* and *Poa Serotina* were the grasses most attacked, while only a single instance of injury to *Setaria viridis* was noticed. An interesting point was that while *Poa Serotina* was so severely injured, *Poa pratensis*, *Poa caesia* and *Poa compressa* were almost exempt. The species of *Elymus* and *Deschampsia* were attacked in the young shoots close to the root, but the others mentioned in the top joint of the flowering stems, by which the appearance known as "Silver-top" was produced. The name "Silver-top" is also applied to the results of the ravages of *Phleothrips poaphagus*, which is now becoming a "first-class pest" in many parts of Canada. The grasses which suffer most from this insect are, early in June, *Poa pratensis*, and, later in the month, *Phleum pratense*. A much more serious matter, however, was a new injury to oats by a species of Thrips, which has been found to be an undescribed species. This insect attacks the flowers of oats just before they leave the sheath, in consequence of which they turn white and die.

An outbreak which may prove to be one of great importance is the appearance during the past summer, in one of our Canadian towns, of large numbers of the European Flour Moth (*Ephestia kuhniella*). Radical measures have, however, been taken by the Provincial Government for its suppression, and I trust that it may be stamped out before it spreads to other centres of the milling industry.

In the United States the attacks of most interest were the following:—The appearance in very large numbers of the Grain Aphis, *Siphonophora avenæ*, in Michigan, Ohio, Indiana and Illinois drew forth many notices in the public press. Perhaps next in importance was the outbreak of an imported fly of the genus *Hæmatobia* which has increased so as to become a serious pest to cattle. It has occurred in injurious numbers in Pennsylvania, New Jersey, Delaware, Maryland and Virginia. Its life history has been studied by the entomologists at Washington and Prof. J. B. Smith in New Jersey. The salient points are already discovered and successful remedies have been made known. The Army Worm (*L. unipuncta*) has done restricted damage in Indiana and has also occurred in Florida. Brood viii. of *Cicada septendecim* has appeared in Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Ohio, Kentucky, Maryland, North Virginia and North Carolina. The Chinch Bug (*Blyssus leucopterus*) has been abundant in Missouri during the past summer and (*Phorodon humuli*) is reported as more abundant in New York this summer than it has been since 1886. *Attacus cecropiæ* has been remarkably abundant in the tree planted regions of the west and north-western States.

The Cotton Worm and Boll Worm have been very abundant and injurious in the cotton fields of the south. Trees and shrubs of all kinds, both in the United States and Canada, have suffered much by the attacks of various leaf-hoppers. These attacks will doubtless all be dealt with by the United States Entomologist or the State Entomologists in their reports, so I shall not now speak of them at greater length than I have done, but will beg you to give me your special attention while I speak to you upon a subject which appears to me to be, at the present time, one of very great importance. It has lately been brought prominently before the entomological world in the pages of *Insect Life*. This is no less than the organization of the active, working, economic entomologists of North America into a permanent association or union, so that an opportunity may be afforded to those students who are specially engaged in the practical application of the science, of meeting periodically to discuss new discoveries and to

exchange experience cannot, I believe, be accorded to them that as little time as possible, and also, of insects should be n

A small number for some years past do good and useful great impulse has been Experiment Station that a sum of \$15,000 tific agricultural ex there have already have entomologists practical information The operations of i of all crops grown, amongst the educate directors of the oth staff. The result o men specially traine at their disposal fo such circumstances view: the discovery —remedies for the these students will localities, and a fac experiments will be and with varying c

Such an opport it is incumbent on of their offices. I v out of our experim the best means of p to gain the confiden are frequently inqu must be simply exp them. Even among the very word "sci of agriculturists; culture, of course avail themselves of spend their lives av as a consequence d which would indeed agricultural entomo articles should be s insects discussed. may be recognised; may be understood existing local circu the pest as may be

During a som them anxious to les them. As a gener

ended the attention
 of Canada and
 "Outworms" were
 few Brunswick and
 ry to orchard and
 y abundant, but it
 were certain kinds
 the attack on oats
 species bred freely
 , Elymus and Poa.
 Ottawa the species
 tacked, while only
 resting point was
 a caesia and Poa
 psia were attacked
 e top joint of the
 is produced. The
 thrips poaphagus,
 The grasses which
 ter in the month,
 injury to oats by
 ecies. This insect
 sequence of which

is the appearance
 s of the European
 een taken by the
 tamped out before

ing:—The appear-
 1 Michigan, Ohio,
 Perhaps next in
 atobia which has
 ous numbers in
 history has been
 New Jersey. The
 made known. The
 has also occurred
 etts, Connecticut,
 rth Virginia and
 dant in Missouri
 abundant in New
 es. been remarkably

injurious in the
 nited States and
 These attacks will
 te Entomologists
 gth than I have
 k to you upon a
 t importance. It
 in the pages of
 orking, economic
 nion, so that an
 d in the practical
 scoveries and to

exchange experiences as to the best methods of work. The value of such an association cannot, I believe, be over-estimated. The recognition which, during the past decade, has been accorded to entomology as a branch of practical agriculture, makes it important that as little time as possible should be wasted upon unnecessary reduplication of experiments, and also, on the other hand, that successful methods of combating injurious insects should be made known as widely and as quickly as possible.

A small number of the States of the Union had employed their State Entomologists for some years past and Canada hers since 1884; all of these officers had striven hard to do good and useful work in the vast field which lay before them. Recently, however, a great impulse has been given to practical science in all lines by the very important "Hatch Experiment Station Act," which was passed by Congress in 1888. This act provided that a sum of \$15,000 should be annually set aside for the purpose of carrying on scientific agricultural experiments in every State of the Union. In consequence of this act there have already been organized over 60 experimental stations, twenty-seven of which have entomologists on their staffs, and these officers have already issued much valuable practical information in the shape of bulletins to the farmers of their respective States. The operations of injurious insects are such an important factor in the success or failure of all crops grown, and the recognition of that fact is now becoming so wide-spread amongst the educated agricultural classes, that, before long, it is beyond question that the directors of the other stations will see the advisability of adding an entomologist to their staff. The result of this will be that we shall have in North America a large number of men specially trained for the work they have undertaken, with sufficient time and means at their disposal for carrying out any experiments which may be necessary. Surely under such circumstances important results must follow. They all have the same object in view: the discovery, as soon as possible, of practical—that is efficient, simple and cheap—remedies for the various injurious insects which destroy produce. The work of all these students will of course have to be carried on independently, in widely separated localities, and a fact which will give special value to their labours will be that similar experiments will be carried out carefully and scientifically under differing circumstances and with varying climatic conditions.

Such an opportunity for showing the value of science has never before occurred, and it is incumbent on the men who accept these positions to recognise also the responsibility of their offices. I would suggest that not only is extreme care necessary in the carrying out of our experiments as official entomologists, but also great thought must be given to the best means of publishing and making known results. Above all things it is necessary to gain the confidence of those for whom we write. The editors of agricultural papers are frequently inquiring for articles upon economic entomology, but they always say they must be simply expressed or they are useless to them, because their readers will not read them. Even amongst highly educated and even cultivated people you find many to whom the very word "science" is a bug-bear, and much more is this the case with a large class of agriculturists; a class which, although it does contain many men of education and culture, of course consists mainly of men who have not had the time nor opportunity to avail themselves of educational advantages. They are, however, as a class, men who spend their lives away from the distractions, largely frivolous and useless, of city life, and as a consequence develop a faculty for observation, thought and practical application which would indeed be a boon to many an aspirant to scientific fame. Writings upon agricultural entomology should be, I think, couched in the simplest language possible; the articles should be short and concise, without too much detail of the life history of the insects discussed. Prominence should be given to the nature of the attack, so that it may be recognised; the essential points of the life history of the insect, so that its habits may be understood and missing links filled in; and, above all, the best remedy under existing local circumstances; and, lastly, a statement of such information with regard to the pest as may be lacking.

During a somewhat extensive intercourse with farmers, I have always found them anxious to learn anything about injurious insects and the means of combating them. As a general thing they are willing to devote both time and labour to any

experiments suggested, if there is only a chance of success; but they complain that frequently writings, which are professedly written expressly for them, are unintelligible, that there is too much detail concerning the life history, or that even under remedies there is frequently a long string given without comments, some of which are good and some useless. Now this is to a certain extent true, and is due I think to two causes, either, as stated in *Insect Life*, that "Economic entomology has heretofore greatly suffered by the writings and pretensions of those who have no sort of appreciation of its real value and importance, but who, writing at second hand upon subjects of which they have no personal knowledge whatever, are just as apt to disseminate error as truth," or perhaps to the fact that some entomologists have tried to cover too much ground, and, while professedly writing articles for the good of a class which it is assumed has no knowledge of scientific terms, at the same time endeavour to maintain their scientific status and secure the credit of priority in description or discovery. I would venture the opinion that it is impossible to combine these two causes advantageously, and that the scientific details and necessary descriptions and discussion of theories would find a more appropriate place in the scientific periodicals, and transactions of societies devoted to the subject; whilst the results—the practical application of our work for the good of the country—should be published where, and in the manner, they can do the most good. It will be seen in this way that I give the highest place of honour to economic entomology, and this I really believe to be a proper arrangement. The systematic classification of orders and genera and the arrangement of large collections so as to understand the proper relationships which exist are matters of engrossing interest, but the intelligent application of this knowledge for the benefit of mankind at large draws such vast consequences in its wake that it demands the attention of entomologists. So great, however, is the field of entomology that it cannot possibly be covered by any one individual, and the work of specialists in every department is necessary. Owing to the institution of the various experiment stations in the United States with their several entomologists, doubtless the attention of many will now be turned to entomology who otherwise would not have thought of it; and also so many men entering enthusiastically upon the field at the same time to do original work will certainly have the effect before long of producing eminent and useful public officers. I therefore make a special appeal to you to consider now whether a union which would be the means of bringing together, at least once a year, all those working specially in economic entomology, would not be a useful institution. Some of the official entomologists have been well trained in economic entomology, whilst others are young men fresh from college and with only a general knowledge of the subject. To these latter, of course, by far the greatest advantage would accrue; there is such an infinity of small things and so many doubts which a word from one of greater experience can settle, that the meeting, if only once a year, where questions of economic interest alone would be discussed, would be, I believe, an inestimable boon to all of us. And, from the favour with which this suggestion has been received by many of the fathers of economic entomology, I believe that even they would reap sufficient benefit from the experience of others to well repay them for any time they might devote to these meetings for the encouragement of others or for the good of the cause. Without going into too great detail, I shall mention one or two of the advantages which it has occurred to me will be secured in connection with such an organization. First of all, it will give opportunities for a large body of earnest workers, in the same field and with the same interests, to become acquainted with each other, and this I consider a point of great importance. I regret to say that it cannot be denied that there is sometimes evidence of unkind feeling towards fellow students in scientific writings. The social intercourse which would be engendered by the union would do much to put an end to this. Many small matters which might offend or hurt can be overlooked, or, as we say, "understood," when we know the man from whom they emanate, and I presume my experience of life cannot have been very widely different from that of other people when I have found far more to like than to dislike in everyone when you come to know them. Well, this union will allow us to know each other. It will give us an opportunity for systematic work. Problems frequently arise of paramount importance to the whole country; by this means

it will be possible to interest to ourselves shall do far better shall gain the confidence together in a solid

Although I have you to express an opinion upon the meeting suggesting the matter would be interesting for discussion to-day

The movement Entomologist, Prof experiments to raise the appreciation of

And now, gentlemen when you elected I hope sincerely that prosper and be the of a large and attached as Christmas, New a social reunion, will general interest. I on in the same as previous meetings, and derive from the pleasures of mutual

At the close of and on motion followed concerning in the President's a Herbert Osborn, A Alwood, W. H. Hal also reported letterworth, C. P. Gillett favored such an organization On motion the Club

The Club met the chair, and proceeded the address.

In reply to a parasites from *Nem* Howard said he had described a *Pteron* a European parasite

it will be possible to delegate certain parts of any special investigation to such students as may have special opportunity therefor.

Above all the union will be an advisory board, either for discussing matters of great interest to ourselves, or for the advice of the Legislature upon occasion of any serious visitation or threatened visitation by insect enemies; and thus while we are united we shall do far better scientific work, we shall uphold better the dignity of our offices, we shall gain the confidence of the public and of the government, and we shall be bound together in a solid union for our own good and that of the country at large.

Although I have taken the liberty of bringing this matter before you now, and ask you to express an opinion on it at once, as you are well aware it is no new idea sprung upon the meeting unawares. As I have mentioned, notices have appeared in *Insect Life* suggesting the matter, and I have myself distributed, to every one who I thought would be interested, a circular notifying them that I proposed bringing the matter up for discussion to-day.

The movement seems to have originated with the very eminent United States Entomologist, Prof. C. V. Riley, who has done so much by his writings and successful experiments to raise economic entomology to the honourable position it now enjoys in the appreciation of intelligent people of all classes.

And now, gentlemen, allow me thank you for the great honour you conferred upon me when you elected me to preside over you during the past year and at this meeting. I hope sincerely that the Entomological Club of the American Association may continue to prosper and be the means of bringing us all together at least once a year, like the members of a large and attached but widely scattered family, who rejoice when, on such festivals as Christmas, New Year's or Thanksgiving Day, an excuse or opportunity is given for a social reunion, where we may discuss with each other, in a friendly manner, matters of general interest. I trust that during the present meeting the deliberations may be carried on in the same spirit of kindness and forbearance which has always characterized previous meetings, and in conclusion I hope that we all may be long spared to meet annually and derive from each other the benefits of scientific discussion and enjoy the social pleasures of mutual intercourse.

I am, gentlemen,
Your obedient servant,

JAMES FLETCHER.

At the close of the address attention was called to the absence of the Secretary, and on motion Clarence M. Weed was elected Secretary *pro tem*. A long discussion followed concerning the advisability of organising such an association as was suggested in the President's address. Letters were read by the President from F. M. Webster, Herbert Osborn, A. H. Mackay, F. B. Caulfield, T. E. Bean, M. H. Beckwith, W. B. Alwood, W. H. Harrington, C. J. S. Bethune, J. B. Smith and C. M. Weed. Mr. Howard also reported letters from L. F. Harvey, Lawrence Bruner, J. P. Campbell, C. W. Woodworth, C. P. Gillette, S. A. Forbes, E. J. Wickson, J. H. Comstock, all of whom heartily favored such an organisation. Those present also expressed themselves in favor of it. On motion the Club then adjourned to 9 a.m. on Thursday.

The Club met on Thursday morning pursuant to adjournment, Mr. Fletcher in the chair, and proceeded to discuss the entomological matters touched upon in the President's address.

In reply to a query from Mr. Howard, Mr. Fletcher said he never bred any parasites from *Nematus ericksonii*, though he had bred thousands of this species. Mr. Howard said he was especially interested to learn, because a few years ago Dr. Packard described a *Pteromalus* parasitic on this insect which had since proved to be the same as a European parasite.

Prof. Cook and Mr. Howard reported the successful use of poisoned baits of clover and similar substances in destroying cut-worms. The former had tried it in general field culture in Michigan. Patches of clover were sprayed with Paris green water, then the clover was cut, placed in a waggon and carried to the field where it was distributed in forkfuls before the crop was planted. The cut-worms fed upon it and were killed. Prof. Smith reported that this method had also been successfully used in New Jersey. Mr. Fletcher called attention to the fact that the worms are not killed immediately but go beneath the soil surface about an inch where they die in the course of a day or two.

Prof. Cook had also tried planting succulent plants in fields of grape vines and apple trees to prevent the climbing cutworms from injuring the buds, with considerable success. He had bred *Meromyza Americana* from oats very frequently. Prof. Smith had often taken adult *Meromyza* in a sweep-net in New Jersey, but had not known it to do any serious damage. He said that the Wheat Midge did some injury in New Jersey.

Mr. Fletcher thought no remedy for the Wheat Midge had been suggested but that of destroying refuse. Prof. Cook advocated pushing the crop to rapid maturity. Prof. Saunders reported this pest very destructive in many parts of Canada. At Prince Edward's Island farmers plant either very early or very late to avoid it. Had lately seen many flies about infested heads which he supposed to be parasites.

Prof. Cook said that one of the most serious pests in Michigan was the wire-worm for which no successful remedy was known. One year's cultivation of buckwheat would not destroy them. He also asked how *Chrysopa* larvæ feed, reporting observations indicating that the juice of the victim was sucked in through the long jaws. Similar observations upon the mode of feeding of *Syrphus* larvæ showed that they partially roll themselves inside out, making a sort of funnel of themselves in sucking their victims.

In speaking of injury to Larches by *Nematus erichsonii*, Mr. Howard reported that Dr. Packard had figured in the forthcoming report of the U. S. Entomological Commission, Larches killed by repeated attacks of this insect, and added that there were Elms on the Department grounds at Washington that had been defoliated year after year by another insect but yet were still vigorous.

Mr. Saunders reported that the bean crop had been badly injured by cut-worms this year.

Mr. Howard called attention to the ease with which parasites of scale insects can be carried from place to place.

Prof. Smith made some remarks on the structural peculiarities of the genus *Agrotis* tending to show that a loosely assembled mass of species is classed under this generic name. He described the variations in the palpi, the frons, the thoracic tuftings, the antennæ, the legs, the wing form and the general habitus, and showed that any definition of the genus based upon the existing assemblage would take in every Noctuid, with naked eyes and spinose tibiae, hind wings not red or banded. He gave some of the characters upon which he had divided the genus and stated that a monographic revision of the species was completed in MSS. and about ready for the printer.

Mr. Weed then read a paper on "Experiments with Remedies for the Striped Cucumber Beetle."

In the discussion which followed Mr. Howard reported that "X. O. Dust"—a patent combination of ground tobacco and some other substances—had been found a specific for the flea-beetle.

Mr. Smith reported that he had found the same substance an excellent remedy for the Horn Fly, Asparagus beetle larvæ, and many other pests. Prof. Cook reported better success with tobacco decoction than dust. Found the decoction the best remedy for use on domestic animals.

Prof. Cook read a paper giving an account of injury to furniture by a small beetle, *Lasioderma serripes* not hitherto reported to have such habits.

The Club then adjourned to meet at 1.30 p.m.

At the appointe
A paper on "E
Clarence M. Weed.

Mr. Smith call
brood of the Elm I
seriously injured by

Prof. Cook ther
concerning spraying
had injured foliage n

A long discussi
the arsenites, in whi
out being the necess

Prof. W. O. A
Agriculture, was the
reference to the co-
Economic Entomolog

The election of
J. Cook; Vice-Presi

On motion of l
ceedings of the Clu

The Club then
A. A. A. S.

On re-assemblin
Predaceous Enemies
ture and discussed
Department of Agric
of all of the species
was discussed by Mr

Mr. H. H. Ly
connection with whi
the question of speci
Smith.

A letter from M
results of breeding ex

The Club then s

ASSO

In pursuance of
Americana, and distr
the A. A. A. S., the f
Fletcher, Clarence M
H. Garman, W. Sau
election, upon motio
Clarence M. Weed a
tages of organization
might be specially de
purpose were made l

At the appointed time the Club was called to order by the President.

A paper on "Experiments with Remedies for the Plum Curculio" was read by Mr. Clarence M. Weed.

Mr. Smith called attention to the fact that in New Jersey there was no second brood of the Elm Leaf Beetle this season. Prof. Hargitt reported that peaches were seriously injured by the curculio in south-western Ohio this season.

Prof. Cook then read an extract from a bulletin of the Michigan Agricultural College concerning spraying with the arsenites, showing that London purple in his experiments had injured foliage more than Paris green.

A long discussion followed concerning the injury of foliage by the application of the arsenites, in which various opinions were expressed, the most important point brought out being the necessity of an exhaustive investigation of the whole subject.

Prof. W. O. Atwater, of the Office of Experiment Stations of the Department of Agriculture, was then introduced to the Club, and gave a pleasant talk, especially with reference to the co-operation of his office with the recently organised Association of Official Economic Entomologists.

The election of officers then took place with the following result:—President, A. J. Cook; Vice-President, C. J. S. Bethune; Secretary, F. M. Webster.

On motion of Mr. Smith the secretary *pro tem* was authorised to publish the proceedings of the Club in *Entomologica Americana*.

The Club then adjourned to meet after the adjournment of the Biological Section, A. A. A. S.

On re-assembling, Mr. L. O. Howard read a paper entitled "On the Parasites and Predaceous Enemies of the Grain Plant-louse," in which he reviewed the previous literature and discussed at some length the rearing by the Division of Entomology, U. S. Department of Agriculture, of nine true parasites of *Siphonophora avenae*. Illustrations of all of the species were exhibited, together with a full series of specimens. The paper was discussed by Mr. Saunders and Prof. Cook.

Mr. H. H. Lyman read a paper on "Variation in the genus *Callimorpha*," in connection with which he exhibited a large series of specimens and discussed at length the question of specific limitations. The paper was discussed at length by Prof. J. B. Smith.

A letter from Mr. Wm. H. Edwards was then read by the Secretary, giving the results of breeding experiments for the season.

The Club then adjourned *sine die*.

CLARENCE M. WEED,
Secretary *pro tem*.

ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.

In pursuance of the call published in the *Canadian Entomologist*, in *Entomologica Americana*, and distributed by James Fletcher, President of the Entomological Club of the A. A. A. S., the following persons met in Toronto on August 28th, at 4 p. m.:—James Fletcher, Clarence M. Weed, A. J. Cook, L. O. Howard, John B. Smith, C. J. S. Bethune, H. Garman, W. Saunders, C. W. Hargitt, and others. Organization was effected by the election, upon motion of Prof. J. B. Smith, of Mr. James Fletcher as chairman, and Clarence M. Weed as secretary. Mr. Fletcher, in taking the chair, set out the advantages of organization, and urged the formation at the present time of an association that might be specially devoted to entomology in its economic aspect. Remarks to the same purpose were made by Prof. Cook, Prof. Smith, Mr. Weed, Mr. Howard, Dr. Bethune

and Mr. Garman. After full discussion, Prof. Cook moved, seconded by Prof. Smith, that we do now decide to organize an "Association of Official Economic Entomologists." Carried unanimously.

Mr. Fletcher submitted a draft of a constitution drawn by Mr. Howard and himself, after consultation with others.

The proposed constitution was discussed clause by clause, amended and corrected, and finally adopted as a whole in the following shape:—

CONSTITUTION.

1. This Association shall be known as the Association of Official Economic Entomologists.

2. Its objects shall be: (1) To discuss new discoveries, to exchange experiences, and to carefully consider the best methods of work; also (2) to give opportunity to individual workers of announcing proposed investigations, so as to bring out suggestions and prevent unnecessary duplication of work; (3) to assign, when possible, certain lines of investigation upon subjects of general interest; (4) to promote the study and advance the science of entomology.

3. The membership shall be confined to workers in economic entomology. All economic entomologists employed by the general or State Governments, or by the State Experimental Stations, or by any agricultural or horticultural association, and all teachers of economic entomology in educational institutions, may become members of the Association by transmitting proper credentials to the secretary, and by authorising him to sign their names to this constitution. Other persons engaged in practical work in economic entomology may be elected by a two-thirds vote of the members present at a regular meeting of the Association, and shall be termed associate members. Members residing outside of the United States or Canada shall be designated foreign members. Associate or foreign members shall not be entitled to hold office or to vote.

4. The officers shall consist of a President, two Vice-Presidents and a Secretary, to be elected annually, who shall perform the duties customarily incumbent upon their respective offices. The President shall not hold office for two consecutive terms.

5. The annual meeting shall be held at such place and time as may be decided upon by the Association. Special meetings may be called by a majority of the officers, and shall be called on the written request of not less than five members. Eight members shall constitute a quorum for the transaction of business.

6. The mode of publication of the proceedings of the Association shall be decided upon by open vote at each annual meeting.

All proposed alterations or amendments to this constitution shall be referred to a select committee of three at any regular meeting, and, after a report from such committee, may be adopted by a two-thirds vote of the members present, provided that a written notice of the proposed amendment has been sent to every voting member of the Association at least one month prior to date of action,

(Signed)	JAMES FLETCHER,	CLARENCE M. WEED,
	A. J. COOK,	E. BAYNES REED,
	JOHN B. SMITH,	H. GARMAN,
	CHARLES J. S. BETHUNE,	C. W. HARGITT.
	L. O. HOWARD.	

The hour being late, Mr. Howard moved an adjournment to the 29th, after the meeting of the Biological Section of the A. A. A. S.—Carried.

The Association met, pursuant to the adjournment, at the call of the Chairman *pro tem*, at Scarborough Heights, near Toronto, at 4 p.m., Aug. 29th; the Chairman, Mr. Fletcher taking the chair. On motion of Prof. J. B. Smith, seconded by Mr. L. O.

Howard, the reading of the constitution as read and adopted by the members then signed the signatures to the who had expressed:

Letters were then read from New York, expressing sympathy to be enrolled as members.

On motion of the Association proceeded with.

Prof. Smith noted that his recognized interest in the world recognition of the Association by Dr. Bethune and others. On motion of Prof.

Prof. Smith noted that the nomination was declined.

Mr. Weed noted that the nomination was declined.

Prof. Cook then

Mr. Howard noted that the nomination was declined.

On motion of the Association to prepare such a list by the Association.

Prof. Cook then

On motion of the Association be held at Scarborough Heights and Experiment Station.

On motion of the

ASSOCIATION

In pursuance of the resolution passed at the meeting was organized, the first meeting of the Association was held at Scarborough Heights, near Toronto, on August 29th, 1908. The proceedings were presided over by Mr. L. O. Howard, Chairman.

A number of the members present were: president, Dr. Riley, curator of insects in the University of Toronto; Mr. L. O. Howard, Entomologist of the

Howard, the reading of the minutes of the meeting of the Committee organizing the Association was dispensed with, and resolved that the members present do sign the constitution as read and approved at the last meeting, and that by their action the Association of Official Economic Entomologists be, and is hereby duly organized. The following members then signed the Constitution in the order named:—James Fletcher, Chairman; A. J. Cook; John B. Smith; Chas. J. S. Bethune; L. O. Howard; Clarence M. Weed; E. Baynes Reed; H. Garman; C. W. Hargitt. The Secretary was authorized to transfer the signatures to the minute book of the Association and to add the signatures of those who had expressed a desire to join in the work of the Association.

Letters were then read from Dr. F. Goding, Illinois, and Dr. J. A. Lintner, New York, expressing sympathy with and approval of the objects of the Association, and asking to be enrolled as members.

On motion of Prof. Smith, seconded by Mr. Weed, the election of officers was then proceeded with.

Prof. Smith nominated Prof. C. V. Riley as first President of the Association, stating that his recognized pre-eminent position as an economic entomologist, and his active interest in the work of establishing this Association, entitled him to the honor and recognition of the Association by election to that office. The nomination was seconded by Dr. Bethune and Mr. Weed each stating the high claims of Dr. Riley to the position. On motion of Prof. Cook, seconded by Prof. Smith, Dr. Riley was elected by acclamation.

Prof. Smith nominated Prof. S. A. Forbes as 1st Vice-President of the Association. The nomination was seconded by Mr. Howard, and Prof. Forbes was elected by acclamation.

Mr. Weed nominated Prof. A. J. Cook, as 2nd Vice-President of the Association. The nomination was seconded by Dr. Bethune, and Prof. Cook was elected by acclamation.

Prof. Cook then took the chair and the meeting was carried on under his presidency.

Mr. Howard nominated Prof. J. B. Smith as Secretary of the Association. The nomination was seconded by Prof. Hargitt, and Prof. Smith was elected by acclamation.

On motion of Prof. Smith, the President was authorized to appoint a committee of two to prepare such by-laws as may be deemed expedient, to be submitted for approval by the Association at its next meeting.

Prof. Cook appointed the Secretary and Mr. Howard as such committee.

On motion of Mr. Howard, it was resolved that the next annual meeting of the Association be held at the time and place where the Association of Agricultural Colleges and Experiment Stations next meets.

On motion of Prof. Smith, the Society then adjourned.

JOHN B. SMITH, Secretary.

ASSOCIATION OF ECONOMIC ENTOMOLOGISTS—FIRST ANNUAL MEETING.

In pursuance of the resolution adopted at the meeting in Toronto, when this society was organized, the association met at Washington, D. C., on the 12th of November, From the New York *Weekly Press* we have obtained the following report of its proceedings.

A number of well known entomologists were in attendance. In addition to the president, Dr. Riley, entomologist of the United States Department of Agriculture, and curator of insects in the United States National Museum, and his principal assistant, Mr. L. O. Howard, who acted as secretary, we may mention: Dr. J. A. Lintner, State Entomologist of New York; Professor S. A. Forbes, State Entomologist of Illinois;

station of Michigan
e; Professor William
or of the well-known
or Lawrence Bruner,
Campbell, entomolo-
entomologist of the
list of the experiment
experiment station of
t station of Virginia;
nesota; Professor M.
are; Messrs. W. H.
nd and T. Pergande,
dge, the Agricultural
ntomological work at
sitions.

operation, to exchange
of methods in certain
comparable, to talk over
its large collections,
flourishing entomolo-
y point of view the
and 14th, and many
d. To some of these

Bordeaux Mixture as
even that the mixture
in remedying grape
also both deters and
n of the mixture to
so for the flea beetle

facts concerning the
had learned the past
was accidental. For
ing their outer rows
ace of the mildew
id not suffer, and it
se of the immunity,
cheap remedies for

nt Insecticides and
ioned an animated
7 the score from the
nd recommendation
id and even against
imously agreed that
d, even by mention,
est it is found to be
nown and generally

s in a paper entitled
he different watery
y timely, in view of
1 and plum curculio.
ss damage to foliage

than any other arsenical mixture, but when boiled in water before dilution it is the most injurious to foliage, showing plainly that it is the dissolved arsenic which burns the leaves, since in a cold, fresh mixture less than 1 per cent. of the arsenic is actually dissolved. Paris green, his experiments showed, injured the leaves more than the cold, white arsenic mixture, and London purple more than the Paris green, but both were less harmful than the boiled solution of white arsenic. All mixtures were of uniform strength, and the tests were most carefully made.

Professor Cook agreed with Professor Gillette as to the relative merits of Paris green and London purple, but Professor Riley and Dr. Lintner were inclined to stand by London purple on account of color, price and well-proven value.

A discussion of great importance to the members of the association was started by Professor Forbes, of Illinois, in a paper on "Office and Laboratory Organization. Professor Bruner, of Nebraska, presented a paper on the corn root-worm, which he instanced as a striking example of the ever-recurring change of habit among insects, which, is continually making new pests from heretofore unnoticed species.

The topic of co-operation was long and thoroughly discussed and many valuable suggestions were made, and the outcome was that a committee, consisting of Professors Riley, Forbes and Cook, Dr. Lintner, and Professor J. H. Comstock, of Cornell University, was appointed to consider and report to the next annual meeting upon a method or methods to secure co-operation among the members of the association.

Other papers were read of a more technical character and consequently of a less general interest, and when the hour of adjournment arrived on the evening of the third day it was found that the programme had not been finished, and the members separated with regret to take up once more in their respective States active warfare against the great and ever-increasing armies of insect pests.

POPULAR AND ECONOMIC ENTOMOLOGY.

WINTER COLLECTING.

In the continuous chain of nature, great interest will be found at every link, and things unexpected, strange and of marvellous beauty will appear at every point. Even in Canada, snow and ice-bound for so many months in the year, there is much collecting which can be done in the winter. A favorite occupation of the writer is to go off collecting with a congenial companion upon snow-shoes. The charm of this pleasant exercise, in which, supported by the light snow-shoes, one can visit places inaccessible during the summer, is in no way diminished by being able to take home with you specimens which will afford ample occupation for many evenings. Starting off in a straight line, many objects of interest are met with as we go along across fields and fences, through woods and swamps and over rivers, hills or even mountains, all levelled and smoothed down to an even surface by their thick covering of ice and snow. In passing through the woods and swamps, cocoons are eagerly looked for on the slender boughs of trees and shrubs. It is seldom that we are not rewarded with cocoons of the large Emperor moths. In crevices of bark and beneath moss, many hibernating insects are discovered of several orders; larvæ of moths and chrysalids of butterflies, beetles and hemiptera. One of our annual trips is to a certain tree for the pretty little homopteron, which forms galls on the leaf of the hack-berry, (*Psylla celtidis-mamma*, Riley) and which passes the winter in a torpid state beneath the scales of the bark of the hack-berry, the color of which it closely resembles. In passing through the swamps, tufts of moss are pulled from any exposed hummocks, to be picked to pieces at home when they have thawed out. There will be found many treasures which we have not found in any other way. Every cluster of leaves adhering to a deciduous tree, or swelling upon a stem, has to be examined for the cause, and if it prove to be the work of insects, must be put into the bag for examination. The only apparatus necessary for these expeditions is a bag slung over the shoulder and a stick with a hook on one end and a spike on the other. The bag acts as

a large pocket, and saves the inconvenience of unbuttoning your coat when perhaps the thermometer is below zero. The hook on the stick is useful for pulling down boughs or pulling yourself out of a hole; the spike for prying off pieces of bark or digging into old stumps.

Objects of great interest, some of which can be better collected, and from which the insects can be more successfully bred when collected in the winter time, are the various kind of plant galls. These require little trouble; all that is necessary is to put them away in glass jars and keep them closed. After a time the occupants begin to emerge, and to the surprise of the uninitiated, although each kind is made by only one kind of insect, from the galls will be produced perhaps half a dozen distinct species. These are most of them parasites upon the gall-maker, or what are known as the inquillines or guest flies. The gall-maker produces the gall upon the plant. In this gall some of these guest flies deposit their eggs, and the young grubs feed upon the substance of the gall, or others again live as parasites, either upon the grubs of the gall-makers or their guests. Watching these as they emerge, and making notes upon them, will be found most entertaining at a time of the year when there is little active life out of doors. A further zest is added to this department of study from the fact that so little has been done in this line that many of the flies so bred will be new to science.

Other places which may be visited in the winter are groves of evergreens, where much will be found to repay the collector. Amongst the leaves of the pines are cases of larvæ, and on the leaves themselves are the burrows of the caterpillars of a tiny moth. Beneath the bark are numerous scolytid bark-borers, and from the solid wood beneath may be extracted the large grub of the timber-borers. To obtain these last, however, an axe will be found necessary. In the garden the horticulturist will find plenty of work with which to occupy himself profitably. The egg mosses of the tent caterpillar should now be collected and destroyed, as well as those of the tussock moths. Clusters of dead leaves should be removed from apple trees, and thin stems cleared of the scales of the oystershell bark-louse and other small insects which winter in rough places on the bark or amongst the buds.

In addition to the above work out of doors, much is to be done during the winter to prepare for the work of the coming season. Apparatus and storing boxes for specimens should be prepared well beforehand, or perhaps when the time comes to use them opportunities will be lost. Some simple elementary book should be procured and read at leisure. In our library at London we have for the use of our members, many books of this nature, which can be borrowed by applying to the librarian. We should recommend to beginners, Kirby & Spence's Entomology, Packard's Entomology for Beginners, and Comstock's Introduction to Entomology.

THE APPLE TREE TENT CATERPILLAR. THE AMERICAN LACKEY MOTH.

(*Clisiocampa Americana*, Har.)

There are two kinds of caterpillars which every year commit serious depredations in our Canadian apple orchards, although they by no means confine their attentions to that tree. These are the larvæ of the American and Forest Lackey moths, two species of brown moths which frequently fly into houses at night during July, and draw attention by their headlong, reckless flight, dashing themselves against the ceiling and the walls and very often finishing up by getting into the lamp chimney. Speaking generally, there is a great resemblance between these two insects in appearance and habits, and the same remedies are applicable for both. When examined carefully, however, they differ considerably in all their stages, and may be easily recognised.

They belong to the *Bombycidae* or Spinners, a family which contains the silk worm moths and several other thick-bodied hairy moths, with large wings but small heads, bearing pectinated antennæ, and having the mouth parts imperfect, or as in those now under consideration not developed at all. The caterpillars of the *Bombycidae* are usually hairy or tufted, and when full grown spin a cocoon for the protection of the short thick chrysalids.

At fig. 3 the appears in the per other species refer (*C. disstria*, Hub.

The American rich reddish-brown parallel lines. In of the wings are o light lines is paler rather darker in the defined irregular w partake of no form of their kind. A die. The eggs (fig.

within a short distance which when laid are them firmly together

A surprising part the eggs are laid thus this condition all the

3 (EN.)

At fig. 3 the different stages of the American Lackey moth are given. This species appears in the perfect state in the beginning of July, about a week earlier than the other species referred to above, which is known by the name of the Forest Tent Caterpillar. (*C. disstria*, Hub. *C. sylvatica*, Har.)



FIG. 1.—Female.



FIG. 2.—Male.

The American Lackey moth (fig. 1 female, fig. 2 male) is a pretty species of a dull but rich reddish-brown color, having the upper wings crossed obliquely by two clear whitish parallel lines. In rare instances these show faintly on the lower wings also. The fringes of the wings are of the same color as the oblique lines. The space enclosed between the light lines is paler than the rest of the wings in the males, but of the same color or rather darker in the females. On the under side all four wings are crossed by a well defined irregular whitish bar. The perfect insects, having their mouth parts undeveloped, partake of no food, but devote the whole period of their short lives to the perpetuation of their kind. As soon as they have paired and the females have laid their eggs, they die. The eggs (fig. c) are deposited in rings upon the smaller twigs of various trees, usually

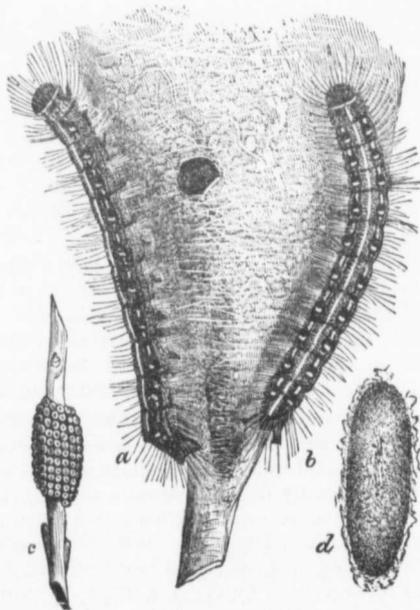


FIG. 3.

within a short distance of the tips. Each egg-cluster contains from 200 to 300 eggs, which when laid are covered with a liquid glutinous substance, which soon dries and cements them firmly together, and protects them from rain and the weather.

A surprising point in the life-history of these insects, is that about a month after the eggs are laid the young caterpillar is fully formed inside the egg, and it remains in this condition all through the winter, only eating its way out of the egg in the following

spring, when the leaves expand. Immediately upon hatching, the young caterpillars consume the glutinous covering of the eggs, and then lose no time in attacking the foliage. They at once begin the construction of their tent, which is a web of fine silk, spun in the nearest fork of the twig upon which they were hatched. This tent is increased in size as the caterpillars grow, and if left undisturbed is sometimes nearly a foot in diameter. The caterpillars are very regular in their habits, marching out in regular processions, each following close behind the one in front of it. From the habit of the larvæ of this genus of marching out in bodies to feed, they are known in Europe as "processionary caterpillars." When their appetites are satisfied, they return again to their tents to rest. They do not feed at night nor in stormy weather. They usually do not leave their tent until after nine in the morning, and have all returned before sundown. They are generally inactive in the middle of the day. When full grown the caterpillars are two inches in length, and beautifully marked with black, white, blue, yellow and brown, in the pattern shown in fig. 3, *b*. The continuous stripe down the back is white, and serves as a distinctive mark by which this species can be at once known from the Forest Tent caterpillar, (fig. 4) which has this dorsal stripe broken up into spots. This

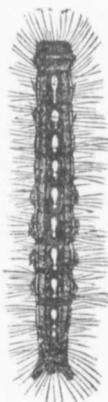


FIG. 4.



FIG. 5.

latter also differs in not constructing a tent, but merely spins a mat of silk on the side of the tree or upon one of the large branches, on or near which it lives more or less in community; but it has not the same social habits as its relatives. Just before they spin their cocoons the caterpillars wander very much, seeking a suitable place. The cocoon (fig. 3, *d*) is greenish yellow, and contains a powdery material like powdered sulphur. The moths emerge in about eighteen or twenty days after the cocoon is made.

Remedies.—The most successful remedies with these insects are undoubtedly hand-picking. During the winter the egg-clusters (fig. 3 *c*, and fig 5) can be easily collected and destroyed. They are always laid upon the small twigs and near the tips, so that if a dull day be chosen they can be easily detected against the sky, and can then be cut off and burnt, when of course that tree is exempt from attack until eggs are laid again the next year. If this precaution is neglected, the nests which are conspicuous objects, before the foliage is fully expanded in spring, must be cut off and destroyed. An invasion from neighboring trees can be prevented by tying a strip of cotton batting around the trunk, which the caterpillars have difficulty in climbing over.

CUT-WORMS.

Of all the injuries committed year after year upon field and garden crops, none are more annoying than those due to the ravages of the various caterpillars known as Cut-worms. These are the larvæ of dull-colored, active moths, belonging for the most part to the three genera, *Agrotis*, *Hadena*, and *Mamestra*, and in North America alone consti-

tute an army of 1 times, very abund- naked, greasy-look which they hide c different color fr plate, known as t tubercles along th hid during the da laid in spring, su moth state, as a h are laid in summe fed the same seas- ing for a short tin vegetation, or in c caterpillars in the the abundant veg capable of more n which is to be g off young cabbage full fed, these cat brown chrysalids weeks, the perfect

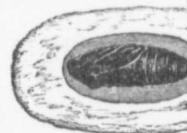


FIG. 6—COCOON

shape; the other kidney shaped. Dart Moth" (*Agrotis*) wings closed and mon and injuriou which is too well worm."

Cut-worms classes, according must be applied i for each. These

1. Climbing
2. Surface C
3. Those whi



FIG. 8—AMPUTATION used for cut-worm stem of the tree o

young caterpillars attacking the foliage. The silk, spun in the increased in size as it increases in diameter. Their processions, each led by an arva of this genus, are processions of caterpillars that go to their tents at night and usually do not move before sundown. When the caterpillars are blue, yellow and green, the back is white, and they are known from the white spots. This

tute an army of no less than 340 different described species, many of which are, at times, very abundant. They may be described, in a general way, as smooth, almost naked, greasy-looking caterpillars, of some dull shade of color similar to the ground in which they hide during the day. The head is smooth and shining, and sometimes of a different color from the rest of the body. On the segment next to the head is a smooth plate, known as the thoracic shield, and there are three or four series of bristle-bearing tubercles along the sides. Their habits are nocturnal, that is, they feed at night and lie hid during the day-time. The habits of most cut-worms are as follows:—The eggs are laid in spring, summer or autumn, and the insects pass the winter either in the perfect moth state, as a half-grown caterpillar, or as a chrysalis. Those which hibernate as moths, lay eggs in the spring and moths are produced in the autumn. The eggs which are laid in 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 so pass the winter beneath stones, heaps of dead vegetation, or in cells beneath the surface of the ground. The injury done by the young caterpillars in the summer and autumn is seldom noticed at those seasons, on account of the abundant vegetation; but, in the spring, not only are the caterpillars larger and capable of more mischief, but the land is cleared of all vegetation other than the crop which is to be grown. They are then particularly troublesome in gardens, cutting off young cabbages, tomatoes, and other plants as soon as they are pricked out. When full fed, these caterpillars burrow into the ground to a depth of some inches and turn to brown chrysalids inside a smooth cell or a light cocoon, Fig. 6. From these, after a few weeks, the perfect moths emerge. They are very active at night, and, when disturbed, have a habit of dropping to the ground and remaining perfectly still as if dead, where, from their dull colors, they are difficult to detect. When at rest, their wings lie horizontally over their backs, and the upper ones entirely cover the lower pair. The upper wings are generally crossed with one or more wavy lines, and always bear two characteristic marks—one about half way down the wing, orbicular in



FIG. 6—COCCON.

shape; the other nearer the tip, reniform or kidney shaped. Fig. 7 shows "The Gothic Dart Moth" (*Agrotis subgothica*, Haw.) with wings closed and expanded; this is a very common and injurious species, the caterpillar of which is too well known as the "Dingy Cut-worm."

Cut-worms may be divided into three classes, according to their habits, and remedies must be applied in a slightly different manner for each. These classes are:—

1. Climbing Cut-worms, or those which climb trees and destroy the buds.
2. Surface Cut-worms, or those which live on the surface of the ground and cut off herbaceous plants just beneath the surface of the soil.
3. Those which combine both of these habits.



FIG. 8—AMPUTATING BROCADE MOTH.

Of the first class, a good representative is the Climbing Cut-worm (*Agrotis scandens*, Riley). The Dingy Cut-worm, the caterpillar of the Gothic Dart Moth (Fig. 7) belongs to the second class, and the "Variegated Cut-worm" (*Agrotis saucia*, Treit.), and the "Yellow-headed Cut-worm," which turns to the "Amputating Brocade Moth" (*Hadena arctica*, Bois.) (Fig. 8) are good representations of the third class.

Remedies.—There are several remedies which may be used for cut-worms. For the climbing kinds, the best remedy is to place round the stem of the tree or bush to be protected, a strip of tin four inches wide, the lower edge

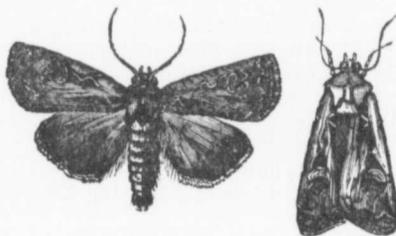


FIG. 7—GOTHIC DART MOTH.

silk on the side of more or less before they spin. The cocoon powdered sulphur. made.

undoubtedly hand- be easily collected he tips, so that if an then be cut off re laid again the spicuous objects, ed. An invasion tting around the

crops, none are s known as Cut- or the most part rica alone consti-

can be pressed into the ground, and the tubular shape is easily preserved by securing it above with a piece of twine. This will effectually keep all cut-worms from the tree, for these heavy-bodied caterpillars are unable to crawl over the smooth surface. A similar expedient is to tie a band of cotton batting around the stem, as the caterpillars cannot crawl over this yielding material.

For surface cut-worms the most efficient remedies are the following :—

1. Keeping down all weeds in late summer and autumn, so as to deprive those species which hatch in the autumn of their food supply and winter shelter.
2. Burning off all the stubble and rubbish as late as possible in spring, when many caterpillars and the eggs of some species will be destroyed.
3. Placing some substance with an obnoxious odor around young plants when first set out, as fresh gas-lime, or sand or sawdust saturated with coal oil or carbolic acid.
4. Wrapping. Young plants may be protected in a large measure by simply wrapping a piece of paper around the stems at the time of planting.
5. Tomato cans with the tops and bottoms cut out, placed over the young plants, or strips of tin as suggested for Climbing Cut-worms, will be found to well repay the trouble and expense of procuring them.
6. Kerosene emulsions. Where these caterpillars occur in very large numbers, spraying infested beds with a kerosene emulsion at night has been found very beneficial.
7. Traps. Placing bundles of leaves or grass, poisoned with Paris green, between the rows of infested beds has been found a useful means of destroying large numbers of these pests.
8. Hand picking. When a plant is seen to have been eaten off, of course the cut-worm should always be looked for and destroyed. They will generally be found close to the root and about an inch beneath the surface.

In addition to the above artificial remedies, nature has provided the farmer with many useful and active assistants in the shape of various predaceous insects. Conspicuous amongst these are the Ground Beetles, which should be known by sight by every one, so that they may be protected, and not, as is often the case, destroyed *because they are insects*. At Fig. 9 is shewn the "Fiery Ground Beetle" (*Catoloma calidum* Fab.), a common and very useful species. Its color is deep black with red (or sometimes green) glowing spots. The grub has been styled the "Cut-worm Lion," on account of its useful habits of destroying these pests.

THE IMPORTED CURRANT SAW-FLY—(NEMATUS RIBESII, SCOP).

Amongst insects which every year make their presence noticeably apparent by their injuries, and thus win the distinction of being "First-class Pests" to the fruit-grower, not one, perhaps, is better known, nor, when not checked in its operations, more annoying, than the currant worm, the larval state of the imported currant saw-fly, *Nematus Ribesii*, Scop. (= *N. ventricosus*, Klug).

This is a European insect, which, although it has only been noticed in America for thirty years, has already spread over a large proportion of the settled parts. Early in the spring when the buds are bursting upon the currant and gooseberry bushes, active yellowish four-winged flies will be seen flying around the bushes or crawling over the unfolding leaves. These are the parents of the currant worms. The two sexes differ a good deal in appearance. At Fig. 10 they are both represented enlarged. The hair-lines at the sides show their natural sizes. The male is shown at *a*. It is slightly the smaller, and is much darker in color. The head and thorax are almost black, with some



FIG. 9—FIERY GROUND BEETLE.

dull yellow spots. wings are glossy w but are not so ofte but fly near the gr emerge from the s The females are la



The greenish- are laid along the 1 Fig. 11 (1). As s which the eggs are very voracious, and ing for them to pas number of eggs la fruit-grower a nece every leaf in a few

When the you in length, with larg same leaf, but as tl bush. They are gr each one of which extremities.

When full gro times of a greenish the surface of the g passes the winter ir brood, and the perf passes the winter ir chrysalids a short ti

Notwithstandi ally necessary for tl bore" is the best. bottom of a pail, an mixture to sprinkle ordinary clothes wh its bulk of common on them, or after th

erved by securing it
is from the tree, for
surface. A similar
caterpillars cannot

ing :—

is to deprive those
elter.

spring, when many



FIG. 9—FIERY GROUND
BEETLE.

is green, between
large numbers of

f course the cut-
be found close to

the farmer with
us insects. Con-
own by sight by
destroyed because
Calosoma calidum
with red (or some-
Lion," on account

SCOP).

pparent by their
the fruit-grower,
ns, more annoy-
saw-fly, *Nematus*

in America for
parts. Early in
y bushes, active
awling over the
two sexes differ
ged. The hair-
It is slightly the
lack, with some

dull yellow spots. The abdomen is dark above but yellow beneath and at the tip. The wings are glossy with dark veins. The males are equally abundant with the females, but are not so often observed, from the fact that they are seldom found on the bushes, but fly near the ground and beneath the bushes as if to welcome the females when they emerge from the soil, beneath which they have passed the winter in their snug cocoons. The females are larger than the males, and of a bright honey-yellow color.

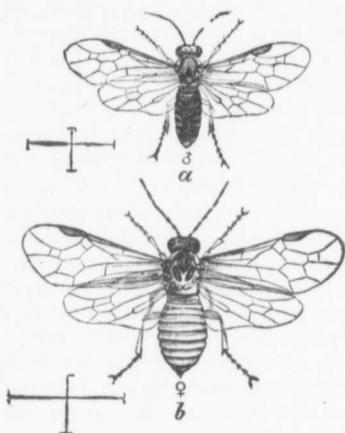


FIG. 10.



FIG. 11.

The greenish-white glossy eggs which are about one-twentieth of an inch in length are laid along the main ribs, beneath the leaves of gooseberries and currants, as shown at Fig. 11 (1). As soon as the young larvæ hatch, they at once attack the leaves upon which the eggs are laid, and eat small holes, as shown in Fig. 11 (2 and 3). They are very voracious, and their growth is very rapid indeed, little more than a week sufficing for them to pass through all their stages. These characteristics added to the large number of eggs laid by each female, make constant vigilance on the part of the fruit-grower a necessity, or he will find his goose-berry and currant bushes stripped of every leaf in a few days.

When the young larvæ come out of the eggs, they are about one-twelfth of an inch in length, with large heads and a semi-translucent body. At first they all remain on the same leaf, but as they grow large they separate and spread in all directions over the bush. They are green at first, then dark bluish green, covered with small black dots, each one of which bears a bristle, and lastly, after the last moult, pale green with yellow extremities.

When full grown they spin smooth oval brown cocoons, which, however, are sometimes of a greenish white colour. Those of the summer brood are generally on or near the surface of the ground, but at a considerable depth beneath it in the brood which passes the winter inside cocoons. The chrysalis state is assumed at once in the summer brood, and the perfect flies appear in about a fortnight. The autumn brood, however, passes the winter in the larval state inside the cocoons, and the larvæ only change to chrysalids a short time before the flies appear in the spring.

Notwithstanding that this insect is attacked by a host of parasitic enemies, it is generally necessary for the fruit-grower to apply active remedies. Of these, "white hellebore" is the best. One or two ounces of this powder mixed in a little hot water at the bottom of a pail, and then filled up with cold water, will give a sufficient quantity of the mixture to sprinkle a large number of bushes. This is most conveniently done with an ordinary clothes whisk. The powder may also be used dry; when mixed with four times its bulk of common flour, it should be puffed over the bushes after rain, when the dew is on them, or after they have been sprinkled with water. This is most conveniently done

by means of the small hand-bellows, now obtainable at all chemists. With regard to the danger of using this material, I will quote from an excellent and very complete article upon this subject by Prof. W. Saunders, which appeared in our Ent. Soc'y, of Ont. Rep. for 1871-2, p. 32.

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

Another insect of the same family, and with very similar habits to the above, is the Larch Saw-fly, *Nematus Erichsonii*, the larvæ of which are now spreading rapidly over the Eastern United States and Canada. I have received inquiries concerning it from several of our members in different provinces of the Dominion, particularly from Nova Scotia and Quebec. The eggs of this species are imbedded in the soft wood of the young shoots of the tamarac when growth first begins in June. The growth is stopped on the side where the eggs are deposited, and the twig becomes distorted and is eventually destroyed. This injury, however, is slight compared with the destruction of the foliage. There are at the present moment in Canada, from the Atlantic coast as far west as Ottawa, thousands of acres of tamarac entirely stripped of their leaves. On another occasion a fuller account of this injurious insect will be given.

THE TIGER SWALLOW-TAIL BUTTERFLY. (*Papilio Turnus*, L.)

Just about the time the lilac bushes open their fragrant blossoms the grand insect shown at figure 12 may be seen either hovering over gardens and sipping the nectar of flowers, or sailing majestically down some woodland glade. It generally appears at



Figure 12.

Ottawa about the first of June, and may be seen for a month or more. Farther to the north it comes later, not appearing at Nepigon, north of Lake Superior, until the end of June. This insect has many characters which make it of interest to the collector. Its

size and beauty r
abundance in dif
lector, and is pri
the habits of its
including the wh
ground colour of
more or less pow
ornamented with
hind angle, and i
angle. In the S
coloured, and be
the black male h
beautiful suffuse
very extended.
tropics, while fro
laid by the fema
about one-twenti
transparent gree
substance which
before the young
the weather fron
during their vai
white spots and
mark also appea
colour. After
greenish brown.
caterpillar assum
segments are nov
yellowish band i
12; that on five
black line does r
each side of segn
outwards. This
enclosing a viole
bar. The sides
segment 4, and
11 there is one
some specimens

After the f
the saddle-shape
uous. The full-
creature. For
ally assumes a p
were before. T
ing. When at
the head is draw
assumes a wedge
ing rapidly to t
this position the
have the appear
This appearance
tection from sc
ready to turn to
suspends itself t
the middle. It
formed chrysalis
white, the two e

With regard to the very complete article Soc'y, of Ont. Rep.

great outcries have been made as it is poisonous when eaten. It is indicated, no fear need be taken immediately after a bunch of fruit will be destroyed. If it be found on any fruit it is ripe and just what is needed which would readily destroy thousands of pounds of fruit by eating this worm, use."

As to the above, is the caterpillar eating rapidly over the foliage concerning it from Nova Scotia particularly from Nova Scotia wood of the young maple is stopped on the leaf and is eventually destroyed by the action of the foliage. It is most as far west as the Great Lakes. On another

(L.)

as the grand insect feeding on the nectar of flowers generally appears at



Farther to the west, until the end of the season. Its

size and beauty make it a striking object in the spring landscape. Although it varies in abundance in different years, it is generally one of the first treasures of the young collector, and is prized accordingly. The variations it presents in different latitudes and the habits of its remarkable caterpillar are of great interest to the student. In the north, including the whole of Canada, the males and females are like our figure, having the ground colour of a pale lemon-yellow, with rich black markings. The broad margin is more or less powdered with blue scales, particularly on the hind wings, which are further ornamented with a conspicuous orange-red spot, bordered with black and blue, near the hind angle, and in the females there is another large spot of the same colour at the upper angle. In the Southern States the specimens of both sexes are larger and more highly coloured, and besides a black dimorphic form of the female also occurs. No specimen of the black male has ever been taken. The only approach to this melanic form is the beautiful suffused variety which is figured below. The range of the Tiger Swallow-tail is very extended. I have some specimens from the arctic circle and others from the tropics, while from east to west it occurs from Newfoundland to Alaska. The eggs are laid by the females singly on the upper side of the leaves of its food plants. They are about one-twentieth of an inch in diameter, sub-globular and smooth, at first of a pale transparent green, much yellower at the base by reason of a more or less abundant waxy substance which fastened them to the leaf; after a few days they turn reddish, and just before the young larvæ hatch they are almost black. The time of hatching varies with the weather from ten to twenty days. The caterpillars are very different in appearance during their various stages. In the first stage the general appearance is black, with white spots and tubercles, and a conspicuous white saddle-shaped mark on the back. This mark also appears after the first and second moults, but is then of a pinkish cream colour. After the second moult the ground colour of the body usually changes to greenish brown. After the third moult the green colour is much more decided, and the caterpillar assumes more of the shape and markings of the full-fed larvæ. The thoracic segments are now enlarged and the saddle-shaped mark is almost obliterated. There is a yellowish band in front of segment 2, and another on the hinder edges of segments 5 and 12; that on five is followed closely by a black line on the front edge of segment 6. This black line does not show when the caterpillar is at rest. The head is pink brown. On each side of segment 4 now appears a pear-shaped yellow eye-like spot, the larger end outwards. This spot is edged by a fine black line; inside there is a heavy black line enclosing a violet spot. Towards the smaller end of this yellow spot is a short black bar. The sides of the body are also ornamented with rows of violet spots, two upon segment 4, and four upon 5, 8, 9, 10 and 11, and two upon 12. On segments 6 to 11 there is one small spot below each spiracle. These spots are more distinct upon some specimens than upon others.

After the fourth or last moult the colour is invariably velvety green, paler beneath, the saddle-shaped mark has disappeared and the yellow marks are all more conspicuous. The full-grown caterpillar is shown at figure 13, and is a formidable looking creature. For two days before it suspends itself to change to the chrysalis, it gradually assumes a purplish brown tint, and the violet spots become more distinct than they were before. The full-grown larva is about one inch and a-half in length when walking. When at rest it is shorter and thicker, the head is drawn out of sight and the body assumes a wedge shape, large in front, tapering rapidly to the last segment. When in this position the yellow spots on segment 4 have the appearance of two large open eyes. This appearance may possibly act as a protection from some of its enemies. When ready to turn to a chrysalis, it leaves its food-plant and seeks some place to pupate. It suspends itself to a silken mat and supports its body by means of a silken girdle around the middle. It changes to a chrysalis the second day after suspension. The newly formed chrysalis is very beautiful, being mottled with green, dove colour, black, and white, the two eye-like spots on segment 4 being very distinct. After a few hours, how-



Figure 13.

ever, the green nearly all fades out and the chrysalis darkens to the tint of dead wood. In all parts of Canada there is only one brood of this butterfly. The eggs are laid in June and July and the caterpillars pupate late in the summer and go through the winter in the chrysalis state. The habits of the caterpillar are sluggish. From the first they spin a mat of silk to rest upon when not eating and sally out to feed. When very young they eat into the edge of the leaf upon which they hatch; but as they grow larger they crawl away to other leaves near at hand, and return again to rest upon the same leaf, all the time there is food at a convenient distance; when this is all consumed they move off to a fresh branch and start another centre of operations. This mat is so spun as to curl the leaf up somewhat and form a platform, so that in case of rain the caterpillar is raised above the wet leaf. When disturbed they have a special means of defence, in the shape of an orange forked scent-organ, which they can protrude at will from an orifice in the second segment. At the same time a strong pungent odour is emitted. The caterpillars possess this organ in all their stages, but seldom use it except in the last stage. The food-plant of this insect is very varied. In this district it is most frequently found upon apple, cherry, ash, birch and aspen trees.

Figure 14 represents a very beautiful suffused melanic male, which was taken in



Figure 14.

July, 1888, by Mr. Robt. Mackenzie, at Collins Inlet, upon the Georgian Bay, eighteen miles east of Killarney, Ont. As this is the only approach to the black male which has so far been discovered, it has been thought well to have it photographed and engraved.* The specimen is in very fine condition, the black and yellow clear and unfaded. The red eye-spot at the anal angle is distinct, and there is another between the extremities of the second and third median veinlets of the hind wing. A few scales of blue shadow the spot at anal angle. There is a conspicuous cloud of the same colour between the second and third median veinlets and a smaller one between the first and second. At the apex of hind wing there is a light cloud of red scales, and a slight tinge of red between the extremities of costal and first subcostal veins.

*The photograph was taken by Mr. H. N. Topley, of Ottawa, by the new Isochromatic process, and the engraving was made directly from the photograph.

BY I

One of the most because of its economic importance upon variation in the feeds on flowers in it thrives upon carpets, *nella*, feeds upon out time aliment, and it tree borers, bark lice

The past season Fab. This insect be Very few of the insect the apple tree twig in the twigs of the apple grape. The insect is plush furniture. Thing it like a sieve. these minute larvæ.

The beetle is light the eyes and tips of of a covering of light head. The thorax. The serrate antennæ, as to rarely show. T are non-striated. T to the sixth, and the grubs are short, curled white, and the hairs thoracic legs are tipped brown lines. The behind. The front of black.

Like all insects gasoline or bisulphid fatal to the insects. the folds, especially sofa or chair with gau

Nearly every y Such incursions, present entomologists in ever

The trees and economic importance cient value to receive recorded from Canada

A NEW CLOTHES BEETLE.

BY PROF. A. J. COOK, AGRICULTURAL COLLEGE, MICHIGAN.

One of the most interesting studies of the scientific entomologist—more interesting because of its economic importance—relates to variation of habits of insects consequent upon variation in their environment. The Carpet Beetle—*Anthrenus scrophulariæ* Linn., feeds on flowers in its native Europe. In the new atmosphere of America it feeds and thrives upon carpets, shawls and other woolen goods. The Apple Maggot, *Trypeta pomonella*, feeds upon our wild haw and other wild fruits. Civilization exterminates its old-time aliment, and it betakes itself to our apples, cherries and plums. The curculio, apple tree borers, bark lice, etc., are other illustrations of the same truth.

The past season I have discovered another illustration in the *Lasioderma serricorne*, Fab. This insect belongs to the family *Ptinidae*. A small family of very small insects. Very few of the insects of this family are noxious; the two best known of which are the apple tree twig borer, *Amphicerus bicaudatus*, Say, which bores in the mature state, in the twigs of the apple; and *Linoxylon basilare*, Say, which attacks the hickory and grape. The insect in question, *Lasioderma serricorne*, Fab., has been found to attack plush furniture. The larvæ in this case do the mischief. They perforate the plush making it like a sieve. I know of several pieces of upholstered furniture utterly ruined by these minute larvæ.

The beetle is light brown in color. There is little variation in the color except that the eyes and tips of the elytra are black. The wing covers appear a little lighter, because of a covering of light hairs which are more dense on the elytra than on the thorax and head. The thorax bends down, so that as we look from above we cannot see the head. The serrate antennæ, which give its name to the beetle, are also close bent under the head, so as to rarely show. The beetle is very small, hardly more than two m.m. long. The elytra are non-striated. The first two joints of the antennæ are small. They then increase to the sixth, and then decrease to the end. The tenth or last joint is rounded. The grubs are short, curled and hairy. They are two m.m. long and one thick. The color is white, and the hairs nearly white. These latter have a slightly yellowish tinge. The six thoracic legs are tipped with black. The upper part of the head shows four yellowish-brown lines. The upper ones are narrowest, while the lateral ones are abbreviated behind. The front of the head is brown, while the jaws and other mouth parts are nearly black.

Like all insects, these beetles—both as larvæ and imago—are very susceptible to gasoline or bisulphide of carbon. Both of these, used in large quantities, were quickly fatal to the insects. Like the Carpet Beetle, they infest upholstered furniture between the folds, especially where the back joins the seat. It is easy to drench such parts of a sofa or chair with gasoline and destroy the larvæ of either moth or beetle.

Nearly every year brings examples of such changes of habits as described above. Such incursions, present and prospective, emphasize the importance of thoroughly trained entomologists in every State of our country.

INSECTS INFESTING WILLOWS.

BY W. HAGUE HARRINGTON, OTTAWA.

The trees and shrubs belonging to the genus *Salix* of botanists, are not of such economic importance as many other of our native woods, but they are at least of sufficient value to receive some consideration from entomologists. About fifty species are recorded from Canada, many of which are arctic or mountain plants, some being shrubs

only a few feet, or even inches, in height. Some of the larger species which grow in less vigorous situations are trees of considerable size. About fifteen species are recorded from Ontario, including those which are planted as ornamental varieties.

Although the wood of the willow is soft, it is smooth and light and is adapted for a variety of purposes, such as making toys, handles of tools, cricket bats, etc. It also furnishes charcoal which is largely employed in the manufacture of gunpowder. The bark of many species is rich in tannin and also furnishes the crystalline substance called salicin, which forms the basis of the salicylic acid so largely employed in the treatment of rheumatism and gout, and as a tonic and febrifuge.

Some species, known as osiers, are largely used in basket making, and of late years the manufacture of household furniture—chairs, tables, baby-carriages, etc.—has become very important. Large quantities of osiers for such work are annually imported by America, which might without difficulty be grown at home.

In the Western States willows are largely employed for hedges and windbreaks, and they should be similarly used by the settlers in our North-West prairie lands. They are quick growers and can be easily propagated, and would be found of far more value than many of the trees and shrubs which are now being planted.

Some of the ornamental varieties, such as the Babylonian, or Weeping Willow, are widely grown, and form a decided addition to our list of trees for lawn planting, etc.

HYMENOPTERA.

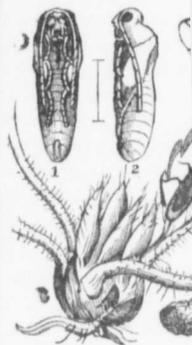
The flowering of the various willows is one of the earliest visible signs that at last the long winter is ended, and that the warmer breath of gentle spring is re-awaking plant and insect life and quickening the pulses of all nature. Now to the opening pendulous spikes of bloom swarm various kinds of bees to sip the honey and to roll and revel in the golden pollen so abundantly produced, until they are themselves so bew powdered, and gilded as to be hardly recognizable. How they rejoice in the bountiful supply of this rich food, and how industriously they labor through the shining hours of the long spring days to transport the honied mixture to the holes and crannies where their prospective progeny are to lazily surfeit themselves with the good things so bountifully provided by the mother insects. In the warm days of late April and early May the air in the vicinity of willows is murmurous with the whirr of tiny wings, as the busy hosts come and go in endless and rapid succession. The majority belong to the genera *Andrena* and *Halictus*, small dark bees, more or less pubescent, those of the latter genus having sometimes the abdomen belted with bands of silvery white hairs. There are also numerous representatives of the genus *Osmia*; small green or bluish bees, having a brush of stiff hairs beneath the abdomen for the collection of the pollen. We also find abundantly, pretty little red bees more or less marked with yellow, which belong to the genus *Nomada* and differ from the preceding species in having no provision for the transportation of food, and in being parasitic in their habits.

I will not take up space by giving a catalogue of the various species, as this paper is intended chiefly to enumerate the foes, not the friends of the willows, and to the latter class the bees fortunately belong. As we all know, the flowers of these trees are *divcious*, that is, the male and female flowers are borne upon separate plants, and fertilization depends upon the agency of the wind or upon that of insects. In this work of fertilization the bees play an important part, as they fly all pollen-coated from tree to tree.

SAW-FLIES. (*Tenthredinidae*.)

Turning from the industrious and useful bees we find another section of Hymenoptera, the larvæ of which feed upon the tissues of plants, and which has consequently been called Phytophaga, from the two Greek words *phyton*, a plant, and *phagō*, to eat. The name commonly applied to these forms is "Saw-fly," from the ovipositor of the female being modified into a saw-like instrument with which to slit the hard tissues of

the leaves or stem
Harpiphorus macul



the head and thorax black with whitish yellow feet. The forming a knob. and the male especially big clumsy legs. producing a small bluish stripe running dorsally about an inch remains during the larva transforms to

I have found den and willow, a following paragraph a paper by Mr. La

"Unless some of the large Willow white willow that be "natural" for the large slug-like occasions, and over suffered when given my instructions and in that way hedges the remedy work made no per

It is to be hoped concerted action, and would be largely of insects.

Trichiosoma but of less size than and thorax are bluish-black, and larvæ are similar pale greenish color

the leaves or stems, preparatory to the insertion of the eggs. Figure 15 represents *Harpiphorus maculatus*, Nort., the Strawberry Saw-fly, in all its stages.

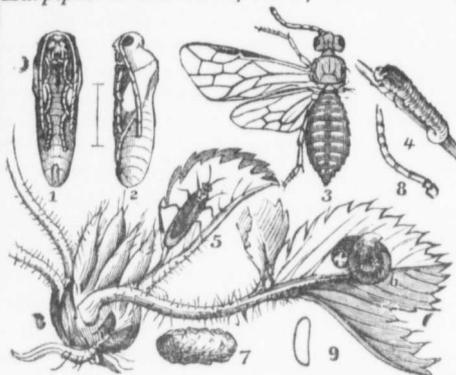


FIG. 15.

The species found upon the various willows may be divided into two groups; those whose larvæ feed openly upon the foliage in its natural state, and those of which the larvæ subsist in concealment upon the substance of galls, produced by themselves, or by other insects, upon the leaves and twigs. Of the former group four species may be mentioned:

Cimbex Americana, Leach. This is the largest of all Canadian (or indeed American) Sawflies, and its larva is correspondingly voracious. The range of this insect extends from "ocean to ocean," and there are several varieties. In the typical form the male is nearly black; the head and thorax have a bluish tinge, and the abdomen a purplish one. The female is black with whitish or yellowish spots on the sides of the abdomen. Both sexes have yellow feet. The antennæ are also yellow, and consist of seven joints, the last three forming a knob. These saw-flies vary in length from three-fourths of an inch to one inch, and the male especially is a very formidable looking fly, with his long, toothed jaws and big clumsy legs. The egg is placed in a slit made upon the upper surface of a leaf, producing a small blister thereon. The larva is of a pale yellowish colour, with a black stripe running down the back, and black dots along the sides. When full grown it measures about an inch and a half in length, and spins a strong brown oval cocoon, which remains during the winter upon the ground under leaves and debris. In the spring the larva transforms to the pupa and the perfect insect appears in May or June.

I have found the larvæ chiefly upon the foliage of elms, but they also infest the linden and willow, and have sometimes been found very injurious to the last named. The following paragraph is quoted from the Report of the U. S. Entomologist for 1888, from a paper by Mr. Lawrence Bruner on Nebraska Insects:—

"Unless some disease or insect enemy soon appears in sufficient strength to diminish the large Willow Saw-fly (*Cimbex Americana*) it will completely destroy our hedges of white willow that grow upon the more elevated prairies. The enemy must necessarily be "natural" for the farmers will not look to the matter themselves. This year again the large slug-like larvæ of this insect appeared in even greater numbers than on previous occasions, and over much more extended areas. In some instances the wild willows also suffered when growing isolated and upon rather high ground. Several farmers followed my instructions and cleared away the debris along their hedges last fall, and burned it, and in that way destroyed the pupæ. Where these were isolated from other infested hedges the remedy was quite apparent, but where other pupæ were close at hand the work made no perceptible diminution in the number of larvæ present."

It is to be hoped that Canadian farmers in such a case would take vigorous and concerted action, and by annually raking up and burning the leaves and debris the evil would be largely overcome in two or three seasons, not only for this but for many other insects.

Trichiosoma triangulum, Kirby.—This is an insect of somewhat similar appearance, but of less size than the preceding, being about three-fifths of an inch long. The head and thorax are black, and the latter is clothed with long whitish hairs. The thighs are bluish-black, and the rest of the legs yellow. The wings have a yellowish lustre. The larvæ are similar in shape and habits to those of *Cimbex*, but somewhat smaller, and of a pale greenish colour, without the black stripe along the back.

Priophorus æqualis, Nort.—This is quite a small species, the perfect fly being hardly one-quarter of an inch in length. The larvæ, however, sometimes occur in sufficient abundance to seriously affect the foliage. They are of a pale yellowish colour, with the back greenish. The head and last segment are black and there is on each side a row of black spots, eleven in number. Upon the back and on each side are two rows of small tubercles, bearing long white hairs. The species is apparently double-brooded as from larvæ obtained in June the flies appeared a month later, and I have observed similar larvæ in August and September. Late last August I saw a small poplar nearly defoliated by larvæ apparently of this species, and two or three weeks later, found similar ones on willows. (Note. In the Fifteenth Annual Report I referred to this species as *Cladius isomera*, Harris, but further examination seems to refer it to *P. æqualis*. The larvæ of *C. isomera*, which also occurs here are, however, of very similar appearance and habits. The European species of this genus are recorded as feeding on willow, poplar, cherry, etc.)

Dolerus arcensis, Say.—One-third of an inch long of a shining blue-black colour, except the partly red thorax; wings smoky. Larvæ 22-footed grubs feeding in June.

Cephus integer, Nort., is an insect having the abdomen more compressed, and of a more generally elongated shape, which has been figured and described by Prof. Riley, (Insect Life, vol. i., p. 8) as injuring the young shoots of various species of willows in and near Washington. The female inserts the egg a few inches below the tip of the shoot, and afterwards girdles the twig. The larvæ bore down through the pith. The ravages are indicated by the wilting of the twigs, and a scorched appearance of the plants. The insect occurs in Canada but I have seen no mention of any attack by it.

For much of our knowledge of the species of saw-flies forming galls, or subsisting upon the galls of some other insects, we are indebted to Walsh, who bred many of the species, and described them in a paper published in the Proceedings of the Entomological Society of Philadelphia, Vol. V, page 284. He enumerates about a dozen species belonging to the genera *Euura* and *Nematus*. The galls produced by the former genus are upon the twigs, being usually enlargements or deformations of the buds, and may be readily found on examining our native willows *Salix cordata* and *Salix humilis*.

Upon the leaves of the same willows during the summer may sometimes be found in great numbers small galls varying in shape, but generally spherical or oval, which on being opened are found to contain small green larvæ, and which are produced by different species of *Nematus*. These insects, however are so much alike that any satisfactory description of them would be far too long and technical for the purposes of this paper. They are, however, closely related to the saw-fly so destructive to the currant and gooseberry bushes, and differ chiefly in being smaller and less robust.

There are also several species which are known as inquilines, or "guests," because they do not produce galls themselves, but subsist upon those formed by the species above named, or by certain small flies which will presently be mentioned.

There is another gall, not mentioned by Walsh, which is very abundant, not upon our native willows but upon *S. alba*, the common white or European willow. Sometimes nearly every leaf will be attacked, and perhaps will be almost covered by oval, or oblong sessile galls, which become reddish as they mature. They produce a very small fly, about one-sixth or one-fifth of an inch in length, and which is apparently the species called *Messa hyalina*, Norton. (Probably a European *Nematus*.)

DIPTERA.

The insects belonging to this order, which are found injurious to various species of willows, are all minute forms, such as are known as gnat-flies or midges, and the majority of them belong to *Cecidomyia*, to which extensive genus belong, also, the destructive clover-midge, Hessian-fly, etc. There are, however, several species of *Diplosis*, another group of midges, among which is found the wheat midge, which are uninvited guests of the *Cecidomyia*.

Everybody must have observed the large swellings at the tips of willow twigs, which bear so much resemblance to the cones of pines, or spruces. These are the result of the

operations of diverse strange that such a terminal bud, of a 1 of the galls to piece reddish maggot. T *Cecidomyia strobiloi* the tips of the twigs unduly abundant th when trees are grow

Fortunately the upon by many specie to the Chalcididae. more than twenty brassicoides, Walsh, ducing the cabbage-g

This order has most beautiful of al that is, they appear on gaily painted win match in richness of seeking visitors. Tl them are so large an Regal, yet as they a so well known to the

Of about sever more or less upon v ever found in much butterfly hibernates return of spring, fli maples. The female the caterpillars from and voracious appeti from one and three-q white dots; with a r erous black branchin

pended by the tip t August. As this spe ous insect if it were destroys nearly every

fect fly being hardly
s occur in sufficient
vish colour, with the
n each side a row of
re two rows of small
ble-brooded as from
ve observed similar
lar nearly defoliated
und similar ones on
is species as *Cladius*
alis. The larvæ of
pearance and habits.
, poplar, cherry, etc.)
ue-black colour, ex-
ceeding in June.

mpressed, and of a
ed by Prof. Riley,
pecies of willows in
elow the tip of the
igh the pith. The
appearance of the
ny attack by it.

galls, or subsisting
o bred many of the
f the Entomological
ozen species belong-
mer genus are upon
nd may be readily
is.

etimes be found in
val, which on being
duced by different
ny satisfactory de-
of this paper. They
nt and gooseberry

"guests," because
7 the species above

undant, not upon
illow. Sometimes
by oval, or oblong
ry small fly, about
the species called

various species of
, and the majority
o, the destructive
Diplosis, another
invited guests of

llow twigs, which
the result of the

operations of different midges, each of which makes its own distinctive gall. It is very strange that such abnormal growths should result merely from the deposition, in the terminal bud, of a microscopic egg by a tiny midge, yet it is the case, and on pulling one of the galls to pieces we will find snugly ensconced in a cell at the base a little pink or reddish maggot. The species which are the most abundant in this neighborhood are *Cecidomyia strobiloides*, O. S. and *Cecidomyia quaphaloides*, Walsh. As these galls are at the tips of the twigs, the growth of the shoots is stopped, and were the insects to become unduly abundant they might dwarf and deform the trees, as does occasionally happen when trees are growing in localities unsuited to them.

Fortunately the larvæ are not secure even in their woody dwellings, but are preyed upon by many species of minute hymenoptera, known as parasites, and belonging chiefly to the Chalcididae. Several species may be bred from one gall; indeed Walsh enumerates more than twenty species of inquilines and parasites from the galls produced by *C. brassicoides*, Walsh, a species which is very abundant in some portions of Ontario, producing the cabbage-gall of the willow.

LEPIDOPTERA.

This order has always been a favorite one with entomologists, as it contains the most beautiful of all insects; the butterflies and moths. The former are diurnal insects, that is, they appear during the daytime, rejoicing in the sunlight, and floating to and fro on gaily painted wing from flower to flower, the most brilliant or lovely of which cannot match in richness of colour, and exquisite markings, the painted wings of their nectar-seeking visitors. The moths are much more numerous as regards species, and some of them are so large and magnificent, as to be deemed worthy of such titles as Imperial and Regal, yet as they are chiefly crepuscular or nocturnal in their movements, they are not so well known to those who have not studied insect life.

Of about seventy-five species of Lepidoptera, of which I have records, as feeding more or less upon willows, only eight are butterflies. The only one of these which is ever found in much abundance is *Vanessa Antiopa*, L., the Camberwell Beauty. This butterfly hibernates during the winter, and is one of the first insects to be seen on the return of spring, flitting about in sunny glades or hovering around the tapped sugar maples. The female then lays its eggs in a cluster, around the small stem of a willow, the caterpillars from which feed in company upon the foliage, and from their numbers and voracious appetites they rapidly defoliate the plant. The full-grown larva measures from one and three-quarters to two inches in length, and is black, sprinkled with minute white dots; with a row of eight dark brick-red spots on the back, and beset with numerous black branching species. The caterpillar changes to a dark-brown chrysalis, sus-

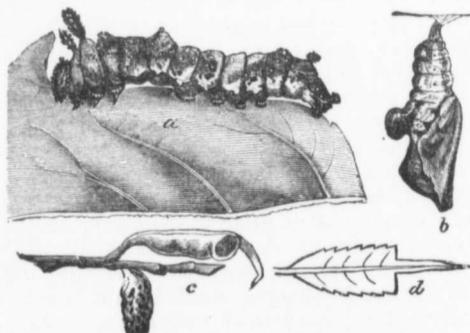


FIG. 16.

pended by the tip under some sheltering projection, and the butterfly appears about August. As this species also attacks the elm and other trees, it might be a most injurious insect if it were not subject to the attack of a minute parasite, which sometimes destroys nearly every chrysalis, and which is so prolific that I have counted more than

400 from a single chrysalis. The butterfly is a beautiful object, of a rich velvety purplish brown, the wings being broadly margined with yellow, in which is a row of pale blue spots.

The various species of *Limenitis* also include the willows in their food-list. This is especially the case with *Limenitis disippus*, Godt., which also feeds on poplar, plum, oak

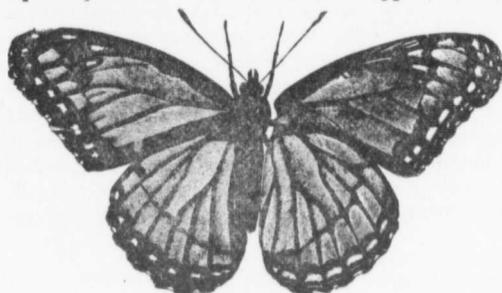


FIG. 17.

and apple. During the summer of 1888 it was sufficiently abundant in this neighbourhood to be considered injurious. The beautifully reticulated eggs (Fig. 18, *a*) are laid late in June, or in July, and hatch in a few days. The caterpillar (Fig. 16 *a*) is of a curiously ornamented form and is variegated with green and whitish colours. The chrysalis is suspended like that of *Antiopa*, but is of a very different shape, (Fig. 16, *b*.) having upon the ventral surface a projection like the centre-board of a yacht. The butterfly issues in ten or twelve days, and the eggs are then laid for a second brood. The larvæ hatched from these, when about half-grown, construct from the leaves neat little cases (Fig. 16, *c*) in which to spend the long, cold winter, and from which they emerge the following spring to complete their growth and metamorphoses. The butterfly (Fig. 17) has a black body, and wings of a warm orange-red colour, with heavy black veins, and a wide, black margin, spotted with white.

Limenitis arthemis, Drury, occasionally feeds upon willows, and in the appearance and habits of the caterpillar closely resembles the previous species. The butterfly, however, is a much handsomer insect, being of a rich velvety purple, with a broad, white band across the wings, the margins of which are ornamented with markings of red and blue. Its graceful flight and rich colouring render it one of the most beautiful of our butterflies.

As the other butterflies which have been recorded as feeding upon willow are only occasional depredators, or are not found in Ontario, I will pass on to the division of the Lepidoptera which contains the moths, the species of which are far more numerous. Of the Sphingidæ, or hawk-moths, two species of *Smerinthus* are reported to include the willow in their list of food plants. *Smerinthus excrucatus*, Abb., feeds upon several species of willows and poplars, as well as on birch, elm, hazel, etc. The larva when full-grown is about two inches in length; of a light green colour, and roughened with numerous white granulations. There are seven oblique yellow lines on each side, and the anal segment bears a nearly straight rose-coloured horn; a similar horn being a distinctive feature of nearly all the caterpillars of the Sphingidæ. When mature the larva drops to the ground and pupates therein as a dark chestnut-brown, tolerably smooth chrysalis. The moth is of a very pretty fawn colour; the head and thorax with a roseate tinge; the body with a dark-brown line above; the wings scalloped on the hinder margin, clouded with brown, and with black and brownish-red spots and patches. Each hind wing has an ocellus, or eye-spot, of pale blue in a black ring.

Smerinthus geminatus, Say, much resembles in its various stages the preceding species, but the eye-spot has two or three blue pupils, whence the specific name, which means twin-spotted.

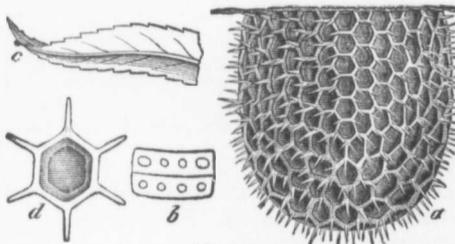


FIG. 18.

The Bombycidæ, species, the most striking state.



Samia cecropia, and other trees. The and its bright colours esting object. The m figured in our reports.



FIG. 20.

The Bombycidae, or silk-spinning moths, furnish us with some very large and beautiful species, the most striking, indeed, of all our insects, whether in the caterpillar or perfect state.

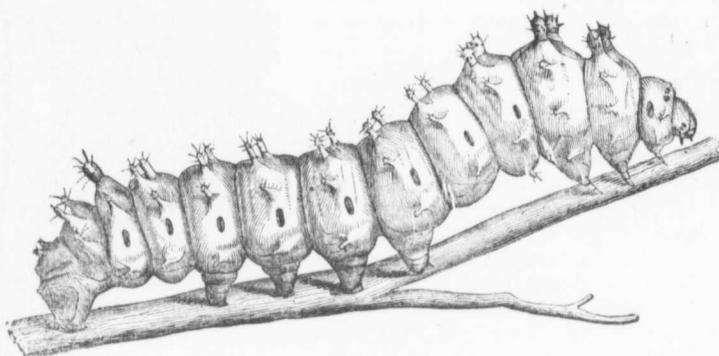


FIG. 19.

Samia cecropia, L., is known by all fruit growers as a depredator upon apple, plum, and other trees. The caterpillar (figure 19) is, when full grown, fully three inches long, and its bright colours and curious spined tubercles render it a very striking and interesting object. The moth, like those of the three following species, has been frequently figured in our reports.

Teles polyphemus, L., the larva of which is shown in Figure 20, is a somewhat smaller and more modestly colored moth, and the caterpillar has not such a formidable appearance. It is, when fully grown, about three inches long, and correspondingly stout, of an apple green color, and ornamented with bright colored tubercles and short lines. It feeds on a great variety of trees.

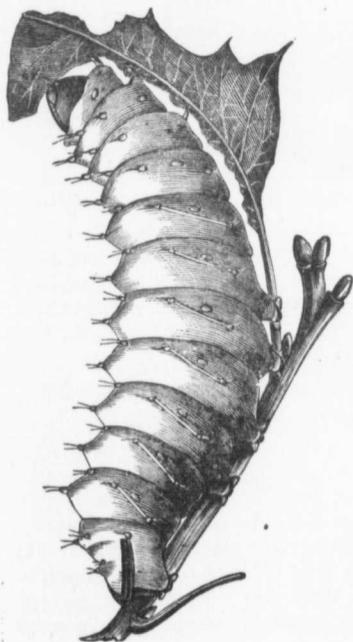


FIG. 20.



FIG. 21.

Actias Luna, L., is the beautiful large pale green moth with long tails to the hind wings, which always evokes the admiration and wonder of those who see it for the first time, and who can scarcely credit (if they have no knowledge of our many splendid insects) that it is a native of Canada. The caterpillar (Fig. 21) resembles a good deal that of the last species, and like it is quite at home on a variety of trees.

Hyperchiria Io, Fab., is a very interesting species, from the fact that its caterpillar (Fig. 22) bears numerous branching spines, which have upon the human skin an effect similar to that of the stinging nettle, and on a sensitive place like the face or back of the hand produce great irritation. The caterpillar is about two inches long, of a pea-green color, and with a lateral white line edged with lilac. It is an almost omnivorous feeder, attacking various fruit and forest trees, as well as the hop, maize, and many other plants. The male moth is of a yellowish colour, varied with black and other markings, and with a large eye-spot on the hind wings; the female is larger, expanding about three inches, and is of a darker colour.

Ecpantheria Scribonia, Stall., is another large and handsome insect, known as the Great Leopard Moth (Figure 23, *a* female and *b* male). The wings are white, with rings, lines and spots of dark brown; the thorax has several black spots with a bluish white



FIG. 23.

centre, and the steel blue abdomen is streaked with yellow. The caterpillar (Figure 24) is one of those which are known as "hedge-hogs" (from their habit of rolling themselves up into a bristling ball), and is often called the "great black bear," because it is covered with tufts of stiff shining hairs. The spaces between the segments (except thoracic ones) are banded with red.



FIG. 22.

Three species of *aris*, Hb., and *H. C.* by having long pen- hairy cocoons, unde



Orgyia leucos caterpillar somewhat. See Figure 26.



Oedemasia co Apple-tree Caterpillar the willow.

The web-mak by their unsightly in orchard or gro

Xyleutes Rob maple. The larv: more), instead of the trunks or larg work great injury

The next lar more numerous, s

Apatela obli (Fig. 28, c), but th (Fig. 28, a), with pupates as shown loosely enclosed i

Apatela Am elm, willow, popl caterpillar, when covered with yell fourth segment, s 4 (En.)

long tails to the hind
to see it for the first
our many splendid



FIG. 22.

insect, known as the
are white, with rings,
s with a bluish white

Three species of *Halesidota* may be mentioned, viz., *H. Maculata*, Harr.; *H. Tessellaris*, Hb., and *H. Caryæ*, Harr. The caterpillars of these are hairy, and are distinguished by having long pencils of black or white hairs upon certain segments. They pupate in hairy cocoons, under stones, loose bark, or other shelters.

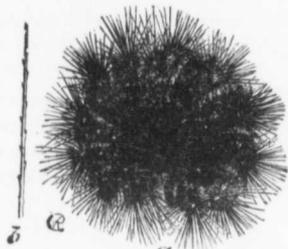


FIG. 24.



FIG. 25.

Orgyia leucostigma, Sm. Abb., the white-marked Tussock moth (Figure 25), has a caterpillar somewhat similarly clothed, but with different ornamentation and colouring. See Figure 26.

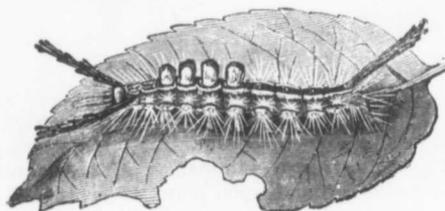


FIG. 26.



FIG. 27.

Oedemasia concinna, Sm. Ab., is the moth whose larva is called the Red-humped Apple-tree Caterpillar (Fig. 27). The larvæ have been found by me to feed also upon the willow.

The web-making caterpillars of *Clisiocampa* and of *Hyphantria textor*, Harr., which by their unsightly webs and omnivorous habits make themselves most unwelcome intruders in orchard or grove, also attack the willows.

Xyleutes Robinæ, Harris, is said to attack the willow as well as the oak, locust and maple. The larvæ (which are pale greenish-white, and attain a length of two inches or more), instead of feeding upon the leaves, as do the preceding species, are true borers in the trunks or large limbs of trees, and, from the size of the burrows excavated by them, work great injury to the trees they infest.

The next large group of moths is that of the Noctuidæ, the species of which, while more numerous, are also smaller and less conspicuous in their ornamentation.

Apatela obliqua, Sm. Ab., the Smeared Dagger moth, is a modestly coloured moth (Fig. 28, c), but the caterpillar, which feeds also on apple, grape, etc., is very gaily coloured (Fig. 28, a), with bright yellow and crimson bands and spots upon a black ground. It pupates as shown in Fig. 28, b, in a thin cocoon attached to the stems of grass, etc., or loosely enclosed in a few leaves.

Apatela Americana, Harris, the American Maple moth, whose larva feeds on maple, elm, willow, poplar, etc., is a paler and somewhat larger moth than the preceding. The caterpillar, when fully grown, is nearly two inches long. It is of a greenish black colour covered with yellowish hairs, and having two pencils of long erect black hairs on the fourth segment, and another on the eleventh.

4 (Eκ.)

caterpillar (Figure 24)
of rolling themselves
because it is covered
except thoracic ones)

The genus *Catocala* contains a large number of fine moths, expanding three or more inches, and having the hinder wings usually banded with red or yellow and black. The larvæ are curious flattened caterpillars about two inches long, tapering to each end, and

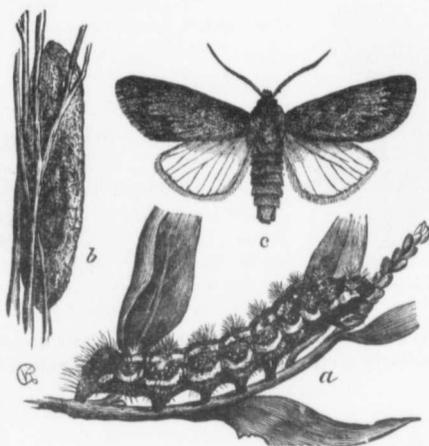


FIG. 28.

having a fringe of fine hairs along the sides. When not feeding they rest upon the twigs in such a manner as enables them to very frequently escape detection. Two species, *C. Parta*, Guen., and *C. Concumbens*, Walk., are recorded from willows. Fig. 29 shows *Catocala Ultronia*, Hubn., a species which is sometimes found upon plum, as mentioned by Prof. Saunders in his "Insects Injurious to Fruits."

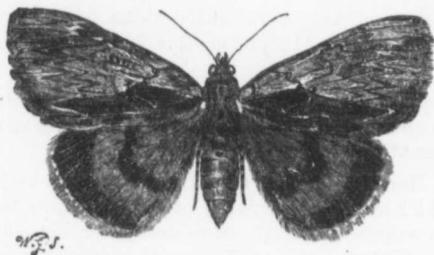


FIG. 29.

The last division of the Macro-Lepidoptera (or larger forms) is the Geometridæ, the larvæ of which are the "loopers" or "measuring worms," so well known, and several of which are occasionally found upon willows.

Among the Micro-Lepidoptera—those minute species (such as the Clothes Moth) which are so numerous and so difficult to distinguish, except by entomologists who have specially studied them—there are many species feeding in or upon the galls produced by other insects, or in mines made in the leaves. When leaves are examined they will often be found to have white blotches upon them, or to be traversed by serpentine white streaks. Closer examination will show that these are internal injuries, produced by the eating away of the inner tissues of the leaf. The minute flattened larvæ will be often found in their burrows, and can be watched in their work of destruction. The habits of these small moths are of interest, but cannot be dwelt upon now.

Of beetles feed less than those of the times upon the foliage belong to the Chrysomelidæ destructive species.

Of Buprestidæ, mention made of *B. ...* markings upon the bark during the summer



FIG. 30.

half an inch in length, which bore under the willow and poplar.

Among the Scolytidæ few species mention *Serica sericea*, Ill., brownish with bands

Cotalpa lanigera It is of a broad ov

beneath. The low teristic it has derived a large part of California June, the beetles lay The eggs are laid in feed upon the root

Lucanus dama beetles is a large, of which have very appearance the "v trees that have been

COLEOPTERA.

Of beetles feeding upon the willow we find the number of species to be but little less than those of the Lepidoptera; or more than half a hundred kinds which subsist at times upon the foliage or wood of these plants. Of these beetles more than two-thirds belong to the Chrysomelidæ and Curculionidæ, and these families include all the more destructive species.

Of Buprestidæ, beetles of the same family as *Dicerca divaricata* (Fig. 30), we find mention made of *Buprestis fasciata*, Fab., a beautiful insect of a bright green, with yellow markings upon the elytra. It is not a common beetle in this locality. I find very commonly during the summer upon foliage, three species of *Agrilus*, slender insects not exceeding



FIG. 30.

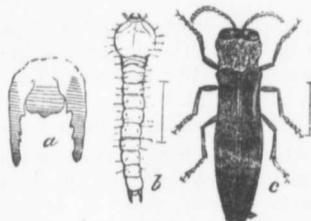


FIG. 31.

half an inch in length (see Fig. 31, *Agrilus ruficollis*, the raspberry borer), the larvæ of which bore under the bark of stems and branches. I have also found both upon the willow and poplar *Pæcilonota cyanipes*, Say, which is one of our rarest Buprestids.

Among the Scarabæidæ (the family to which the May-bugs belong) there are but few species to mention. The most common of these are *Hoplia trifasciata*, Say, and *Serica sericea*, Ill., both about one-third of an inch long, the former nearly black, or brownish with bands of golden pubescence, the latter a rich purplish or plum colour.

Cotalpa lanigera, Linn, is a much larger beetle (Fig. 32) being nearly an inch long. It is of a broad oval form, and of a rich yellow or golden hue above, and coppery

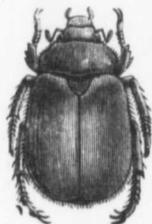


FIG. 32.



FIG. 33.

beneath. The lower surface bears a thick coat of fine whitish hair, from which characteristic it has derived its specific name, *lanigera*, or wool-bearer. It is found throughout a large part of Canada (although not occurring at Ottawa), and appears in May and June, the beetles hiding during the day and feeding at night upon various kinds of trees. The eggs are laid in the ground and the larvæ (Fig. 33), like those of many Scarabæidæ feed upon the roots of plants.

Lucanus dama, Thunb., which belongs to the closely allied family *Lucanidæ*, or Stag beetles is a large, smooth, brown beetle found in various parts of Ontario, the males of which have very long curved mandibles. The larvæ (Fig. 34) resemble in general appearance the "white grubs" of the May-beetles, and live in the trunks and roots of trees that have been injured or have commenced to decay.

Of the long-horned wood-boring beetles, the Cerambycidae, the only species which seems to infest the willow here is *Saperda mutica*, Say. It is a handsome beetle, about five-eighths of an inch in length, of a blackish colour, but more or less clothed, especially

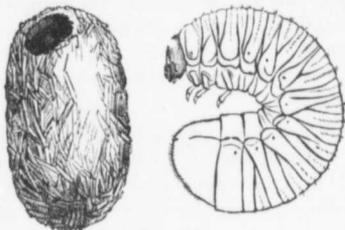


FIG. 34.

beneath, with an ochreous or tawny pubescence, There is a bright stripe of this pubescence on the head; the thorax has three bands, one on the back and one on each side, and the elytra are prettily mottled. The habits of this beetle are not, so far as I know, recorded, but I think it undoubtedly a borer in our native willows, upon which I have taken it (on one occasion in the act of copulating) in June and July.

This beetle belongs to an interesting genus, of which there are thirteen American species, all of which occur in Ontario, and the habits of which are well known to be very injurious to various trees. *S. calcarata*, to which *mutica* is very near, is the poplar borer; *candida* (Fig. 35) is the apple tree borer; *Fayi* attacks the small limbs of thorns; *cretata* has been destructive to apple trees; *vestita* is the common enemy of the basswood,



FIG. 35.

and also attacks the European linden, which is planted as a shade tree in many towns in Ontario; *discoidea* bores severely in hickories; *tridentata* and *lateralis* attack the elm; *puncticollis* infests grape vines and probably the Virginia creeper; *moesta* produces unsightly gall-like swellings on the limbs of poplars, and *concolor*, the last of the species, is another inhabitant of the willows.

The habits of *Saperda concolor* are described by Dr. Hamilton in a paper which will be found in Ann. Report No. XVIII. The larvæ bore in the canes of *Salix longifolia*, often causing their death the following year.

The Chrysomelidæ is a family of beetles which contains a great many species, mostly of small size, but often doing great damage to vegetation by their immense numbers; feeding for the most part, both in the larval and perfect stages, upon foliage. In appearance the larvæ and beetles of the larger species much resemble the Colorado potato-beetle, the different stages of which are well shown in Fig. 36: *b, b, b*, larvæ at different stages; *c*, the pupa; *d, d*, the beetle.

Chrysomela Bigsbyana, Kirby, and *C. spirea*, Say, are two species found upon native willows. They are not quite so large as the potato-beetle and are more prettily marked, having the head and thorax bronzed or greenish, and the wing-covers pale with sutural lines and scattered dots of brown. The larvæ are pale, stout grubs, feeding upon the leaves of various plants.

Anomæa laticla
one-quarter of an inc
the head, thorax and
of the latter. The fe
very uncommon feat

Of the genera
abundant upon the f
inch or less in lengt



Another group
the posterior legs g
Their saltatorial po
Disonycha alternat
on the wing-covers

belonging to *Crep*
may be readily re
turnips, cucumber
and its larvæ ridd

ally species which
ome beetle, about
clothed, especially

Anomæa laticlavata, Forst, is sometimes abundant in June and July. It is about one-quarter of an inch long and half as wide; the abdomen, legs and antennæ blackish; the head, thorax and elytra, yellow, with a broad, purplish black stripe at the junction of the latter. The forelegs of the male are very much longer than those of the female, a very uncommon feature of our Chrysomelidæ.

Of the genera *Pachybrachys*, *Diachus*, *Paria*, etc., there are several species always abundant upon the foliage of willows, and all small cylindrical beetles, one-eighth of an inch or less in length, and often prettily colored.



FIG. 36.

Another group of abundant and injurious beetles is composed of small species having the posterior legs greatly developed, and, consequently, jumping with the greatest agility. Their saltatorial powers have earned for them the term flea-beetles. The larger species, *Disonycha alternata*, Ill., and *D. punctigera*, Say, are yellowish above, with black stripes on the wing-covers, and are one-fourth or one-fifth of an inch long. The smaller ones

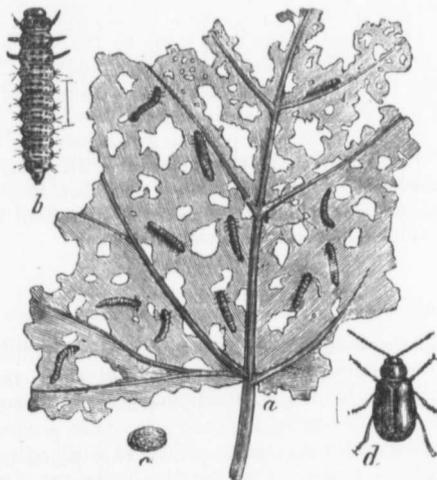


FIG. 37.

belonging to *Crepidodera*, etc., are usually uniformly coloured bronze, green or bluish, and may be readily recognized as relatives of the common flea-beetles which injure grapes, turnips, cucumbers, etc. Fig. 37 shows the grape-vine flea-beetle, *Graptodera chalybea*, and its larvæ riddling a leaf.

ripe of this pubes
e on each side, and
o far as I know,
pon which I have

thirteen American
known to be very
ear, is the poplar
ll limbs of thorns;
y of the basswood,

in many towns in
s attack the elm;
oesta produces un-
st of the species, is

a paper which will
f *Salix longifolia*,

any species, mostly
mmense numbers;
oliage. In appear-
rado potato-beetle,
t different stages:

found upon native
e prettily marked,
pale with sutural
feeding upon the

Galeruca decora, Say, is a beetle slightly larger than the grape-vine flea-beetle, and of the same shape, but has not the hind legs formed for leaping. Prof. Riley (Rept. U. S. Entomologist, 1884) states as follows of this species in connection with insect attacks upon willows near Washington: "The most numerous and most dangerous of these enemies is, beyond question, the Willow Galeruca (*Galeruca decora*, Say), of which young larvæ and imagos were met with everywhere on the leaves. . . . Full grown larvæ were not found early in June, and only a few egg clusters. Next in number comes *Colaspis tristis*, which in the imago state preferably feeds upon the very young, not yet fully developed leaves. Its larva, which no doubt has subterranean habits, was not met with, and it probably feeds on the roots of some other plants."

Lina lapponica, Linn., is a dark yellowish beetle, with black dots upon the elytra, much resembling in size and shape *Diabrotica 12-punctata*, Oliv. (see Fig. 38), but having the thorax wider and the spots upon the elytra more numerous. The larvæ feed upon willow and alder, and are of a dingy yellowish white colour, with black head and legs, and have upon the back and sides rows of small dusky tubercles which exude drops of a disagreeable secretion when the larvæ are disturbed. This species varies greatly in colour and the specimens I have bred were generally paler than those captured in the imago condition.



FIG. 38.

The remaining beetles all belong to the Rhynchophora or "beak-bearing" division of the Coleoptera, and nearly all to the extensive family Curculionidæ. The larvæ of these weevils are short, fleshy, whitish grubs, feeding upon various portions of plants, and generally concealed in cells or short burrows, so that they are seldom discovered until their operations have been some time in progress.

The largest of about twenty species which I have found upon willows is *Lepyrus geminatus*, Say; sometimes it appears quite abundantly, but never upon other plants. The habits of the larvæ are not known to me, but in all probability they infest the roots of the trees upon which the beetles are found. The beetle is a little over one-half an inch long, with a stout beak, equal in length to the thorax. The general colour is greyish; the thorax has an orange line on each side, and there is a dot of the same colour on each elytron near the middle.

Of Apion and Anthonomus there are several small species, either black or modestly coloured. Some of these breed in the galls made by the saw-flies and midges before described, and the habits of others are not yet fully known. There are also species belonging to genera allied to Anthonomus, including a number of species of the genus *Orchestes*. These little weevils correspond to the flea-beetles of the Chrysomelidæ, as they have the posterior legs enlarged, and possess great jumping powers. The beetles feed upon the leaves, of which they riddle the epidermis with numerous small holes. The habits of the larvæ are not known to me. The most abundant species is *O. pallicornis*, an entirely black insect, and another which is sometimes abundant is *O. rufipes*, which is smaller, and has, as its name denotes, red or yellowish legs.

HEMIPTERA.

Of the "bugs," properly so-called, ten or fifteen species, including some Aphides or plant-lice, are recorded in my notes, but as the extent of their ravages, and their life-histories are imperfectly known to me, I shall not give any account of them in this paper.

In conclusion it may be stated that my object in this paper has not been to give a complete catalogue of all the species of insects found upon the various willows, or to describe them minutely. It has been rather to give a general idea of the great number of these depredators, and the different classes to which they belong. To have given the name, description and complete history of every species would have made this paper much too long, and too technical for the general readers of this Report, and would also

have required an attention. In Bulletin in 1881, upon the one hundred species records made by of this paper increase probably be almost country, for in Eu

If we examine antly tenanted by may be observed to else converting them to conceal them from portion of the tree allotted task. It is the young and vig has been injured in being the long-ho tions, permitting massive trunk m and fill its place. insects perform a orchard and the t and it behaves us found the good w particular manner to take effective n those which are b

I have, in th injure oak trees, (so largely to our

1. THE LOCUST, FAMILY, BE

This is proba structive to the l inches across the dusky lines and s much smaller, an are black, with a about the middle their appearance, remain quiet upon tance, as her bod.

vine flea-beetle, and Prof. Riley (Rept. U. S. Geol. Surv., 1859, p. 100), with insect attacks dangerous of these (Fig. 38), of which young Full grown larvæ in number comes very young, not yet habits, was not met

ts upon the elytra, (Fig. 38), but having the larvæ feed upon ar, with black head ll dusky tubercles larvæ are disturbed. I have bred were

bearing" division. The larvæ of ions of plants, and a discovered until

willows is *Lepyrus* upon other plants, y infest the roots r one-half an inch ur is greyish; the me colour on each

er black or mod- and midges before are also species ies of the genus *Chrysomelidæ*, as rs. The beetles small holes. The *O. pallicornis*, an *rufipes*, which is

er black or mod- and midges before are also species ies of the genus *Chrysomelidæ*, as rs. The beetles small holes. The *O. pallicornis*, an *rufipes*, which is

er black or mod- and midges before are also species ies of the genus *Chrysomelidæ*, as rs. The beetles small holes. The *O. pallicornis*, an *rufipes*, which is

er black or mod- and midges before are also species ies of the genus *Chrysomelidæ*, as rs. The beetles small holes. The *O. pallicornis*, an *rufipes*, which is

er black or mod- and midges before are also species ies of the genus *Chrysomelidæ*, as rs. The beetles small holes. The *O. pallicornis*, an *rufipes*, which is

er black or mod- and midges before are also species ies of the genus *Chrysomelidæ*, as rs. The beetles small holes. The *O. pallicornis*, an *rufipes*, which is

INSECTS INJURIOUS TO THE OAK.

BY F. B. CAULFIELD, MONTREAL, P. Q.

If we examine a tree during the summer months it will generally be found abundantly tenanted by insects, some resting upon the trunk and larger limbs, while numbers may be observed upon the leaves, either sleeping or busily engaged devouring them, or else converting them into dwellings to afford them shelter from the storms and rains, or to conceal them from the numerous enemies who are constantly seeking for them. Every portion of the tree has its insect guests, each quietly and effectually performing its allotted task. It seems to be a law of nature that the old and weak must give place to the young and vigorous, hence a tree that has been unable to withstand the storm, or has been injured in any way, is speedily attacked by insects, conspicuous amongst them being the long-horned beetles, *Cerambycidae*; these bore into and tunnel it in all directions, permitting the air and moisture to enter, thus hastening its decay, and soon the massive trunk moulders and crumbles into dust, allowing a fresh growth to spring up and fill its place. In this way, so long as the forest is left in its natural condition the insects perform a good work. But when man steps in and the forest gives place to the orchard and the trees are reserved or planted for shade or ornament, the case is different, and it behoves us to study the habits of the insect inhabitants so that we may not confound the good with the evil, that we may know the times of their appearance and the particular manner in which the different species work, in order that we may be prepared to take effective measures to exterminate such as are injurious, and protect and foster those which are beneficial.

I have, in this article, endeavored to give a brief account of some insects known to injure oak trees, (*Quercus*) drawing freely upon those entomologists who have contributed so largely to our knowledge of the subject.

INJURING THE TRUNK.

1. THE LOCUST CARPENTER MOTH. *Xyleutes robinia* (Harris.) ORDER LEPIDOPTERA, FAMILY, BOMBYCIDAE.

This is probably the most injurious insect attacking the red oak, and is equally destructive to the locust and several species of poplar. The female measures about three inches across the expanded wings, the front wings are grey marked with a network of dusky lines and spots, the hind wings are dusky, and darker at the base. The male is much smaller, and his front wings are darker than those of the female, the hind wings are black, with a large ochre-yellow spot. Dr. Harris states that the moths come forth about the middle of July. Dr. Fitch gives June and the forepart of July as the time of their appearance, the latter agrees with my own experience. During the day the moths remain quiet upon the trees, indeed I doubt that the female ever flies to any great distance, as her body is so large and unwieldy, owing to the number of eggs with which it

is distended, that protracted flight would appear almost impossible. and by the time the eggs are deposited she is exhausted and incapable of much exertion. The male, however, flies strongly and with great swiftness. Some years since a balsam poplar growing in front of my windows was badly injured by this insect, which along with *Saperda mæsta*, killed it in a few years. Upon one occasion, early in the afternoon, a male flew from the tree, although the sun was shining brightly at the time; it appeared, however, to be confused, as it settled on the road about twenty feet from the tree.

Immediately after sunset the males made their appearance, flying swiftly up and down the street; after dashing past the tree a few times they would circle around it, and finally make their way up amongst the limbs at their junction with the trunk, where no doubt the females were resting. On several occasions females were attracted by light, blundering in with a heavy labouring flight; the males appeared to be indifferent to it as none entered the house.

Dr. Fitch states that this is a most prolific insect, a specimen that he obtained having extruded upwards of three hundred eggs within a few hours of its capture. The eggs are of a broad oval form and about the size of a grain of wheat, being the tenth of an inch in length and three-fourths as thick, of a dirty white color with one of the ends black. When highly magnified their surface is seen to be reticulated or occupied by numerous slightly impressed dots, arranged in rows like the meshes in a net. From observing her motions in confinement I think the female does not insert her eggs in the bark but merely drops them into cracks and crevices upon its outer surface. They are coated with a glutinous matter which immediately dries and hardens on exposure to the air, whereby they adhere to the spot where they touch. (Fitch.) As soon as hatched the young caterpillar burrows into the tree, at first feeding upon the soft inner bark, but as it grows it sinks deeper, finally penetrating to the solid heart wood. When about to assume the chrysalis form it changes the direction of its burrow, working outwards until it reaches the bark, lining the passage with silk, then going back a little distance it spins a cocoon and changes to a chrysalis. The caterpillar is of a reddish color above, the head is black, while before pupating it changes color to white, tinged with pale green. When fully grown it measures two inches and a half or more in length and is nearly as thick as the end of the little finger. (Harris.)

The chrysalis is an inch and three-quarters long and is of a chestnut color, the forepart darkest. On the upper side of each segment of the abdomen there is a row of tooth-like projections, by means of which when about to disclose the moth, the chrysalis pushes itself forward until partly out of the tree. The moth now ruptures the chrysalis and creeps out, leaving the empty shell sticking in the mouth of the burrow.

As it is very difficult to see the moths when resting on the trees, any attempt to reduce their number by handpicking would be useless, but coating the trunks with soft soap in the early part of June would probably prevent the moth from laying her eggs on them, and any tree known to be badly infested should be cut down and burnt. Another species, the *Xyleutes querciperda* of Fitch, also attacks the oak but appears to be much less common than the robinia.

2. The Thunderbolt Beetle, *Arhopalus fulminans* (Fabr.) ORDER COLEOPTERA; FAMILY CERAMBYCIDÆ.

This pretty beetle is blackish brown, with slight dark-blue reflections; the legs and antennæ are of the same colour, the latter being scarcely longer than the body. The top of the head and the sides of the prothorax and under side of the body are covered with pale gray pile, while certain silver markings on the wing-cover are composed of similar close-set fine hairs. The hairs on the sides of the prothorax enclose a conspicuous black spot, while the top is black and more closely punctate than the wing-covers. The latter are each crossed, by four acutely zigzag lines composed of microscopic hairs, forming W-like bands on the elytra; the basal lines being less distinctly marked than the others. The ends of the wing-covers are also tipped with gray, especially on the inner side of the end. The legs are pitchy brown with light hairs, and with a reddish tinge on the terminal joints (tarsi). It is a little over half an inch long. (Packard).

Dr. Fitch states it is 3 inches long and 0.5 inch wide, and has a letter U."

It changes to a

In the latter part of the season, oak that had been killed by the beetle, falling backward and matted. Copulation usually dropping an egg, appeared to keep all the sides, under surf

This species in s

That species how to Dr. Harris, while egg at a time. Dr Fitch, in 1871, and this I believe he had appeared several times in June, but there were pl

In 1873 I found it on the top branches of the oak, but the top branches of the species has been found

3. THE NOBLE CERAMBYCIDÆ:—

This fine beetle is of a chestnut color, the wing-covers being marked with five specimens at the base of the mainder close beside attacks the oak. Dr. Fitch states that it attacks chestnut at Providen and oak I think the chestnuts are not found only food plant in E

4. THE COMMON CERAMBYCIDÆ

Length half an inch. The wing-covers are marked with brown spots. Underneath the wing-covers are margined with white. It has been found of a fallen (probably) one transforming to is of the usual form row, and extending burrow being 5 m.m.

I found several quietly resting beneath the roots and on the

Dr. Packard states it is found on an old sugar maple, (Dr. Fitch).

Dr. Fitch states that the larva "excavates a burrow in the soft-sap-wood about 3 inches long and 0.20 in diameter, this burrow having the shape of a much bent bow or a letter U."

It changes to a pupa in the same cell, the beetle appearing in July. (Packard.)

In the latter part of June 1871 I found numerous specimens of this beetle on a red oak that had been blown down on Montreal mountain. They were busily engaged travelling backward and forward along the trunk in search of partners. I observed several pairs mated. Copulation was of short duration and was frequently repeated, the female occasionally dropping an egg in a crevice of the bark, no incision being made for its reception. They appeared to keep altogether to the upper surface of the main trunk, none being seen on the sides, under surface or even the larger branches.

This species in some of its habits resembles the locust borer *Cyllene robiniae*. (Harr.)

That species however, drops its eggs in clusters of seven or eight together, according to Dr. Harris, while *A. fulminans*, as observed by me, certainly only deposited a single egg at a time. Dr. Harris believed that *C. robiniae* completed its transformations in one year, and this I believe is the case with *A. fulminans* also. The tree that I observed them on, had apparently not been attacked up to the time it had been blown down in 1871, as it appeared to be perfectly sound and healthy and was in full leaf. I examined it several times in June and July 1872, but did not find a single beetle either on or about it, but there were plenty of holes showing where they had escaped.

In 1873 I found several specimens, also on a red oak; this tree was standing, but the top branches were dead and a few years finished it. Dr. Packard states that this species has been found attacking the chestnut (*Castanea vesca*) by Mr. R. B. Grover.

3. THE NOBLE CLYTUS, *Calloides nobilis*, (Harris). ORDER COLEOPTERA; FAMILY CERAMBYCIDÆ:—

This fine beetle measures almost an inch in length; it is of a dark blackish brown color, the wing-covers marked with two spots and three broken lines of yellow. I took five specimens at the same time and place as *A. fulminans*, two on the tree and the remainder close beside it, and although I did not find it ovipositing I am satisfied that it attacks the oak. Dr. Packard states that it has been found beneath the bark of the chestnut at Providence by Mr. George Hunt, and as *A. fulminans* bores in both chestnut and oak I think there is little doubt but that *C. nobilis* does the same. Moreover the chestnuts are not found at Montreal so far as I am aware, so that the oak is probably its only food plant in Eastern Canada.

4. THE COMMON OAK BORER, *Hylotrechus colonus*, (Fabr). ORDER COLEOPTERA; FAMILY CERAMBYCIDÆ:—

Length half an inch, color dark reddish brown, two narrow undulated pale grey bands at base of wing-covers. End of wing covers pale grey, enclosing two round dark brown spots. Under surface dark brown with two round yellow spots. Abdominal segments margined with yellow. Legs and antennæ reddish brown. Dr. Packard states that he has found "the larva of this pretty beetle in abundance mining under the bark of a fallen (probably white) oak near Providence, May 26th several pupæ also occurred, one transforming to the beetle May 27th. The mine extends up and down the trunk and is of the usual form of Longicorn mines, being a broad, shallow, irregular, sinuous burrow, and extending part of the way around the trunk, the diameter near the end of the burrow being 5 m.m."

I found several specimens of this beetle along with the preceding species, but all were quietly resting beneath the trunk, (the tree was lying on a bank of earth torn up with the roots and on the larger limbs, leaving the trunk clear of the ground).

Dr. Packard states that Mr. George Hunt has found this species under the bark of an old sugar maple, and it has been found running on dead hickory by Mr. W. H. Harrington.

5. THE OAK BARK BORER, *Urographis fasciatus*. (De Geer.) ORDER COLEOPTERA ;
FAMILY CERAMBYCIDÆ :—

The grub of this beetle feeds on the inner bark of the oak, transforming to a long-horned slightly flattened beetle, of a yellowish grey color, thickly covered with dark spots and dashes.

The female is provided with a straight awl-like ovipositor, nearly as long as her body with which she perforates the bark when depositing her eggs.

"The worms from these eggs mine their burrows mostly lengthwise of the grain or fibre of the bark, and the channels which they excavate are so numerous and so filled with worm dust of the same color with the bark that it is difficult to trace them. The eggs are deposited the latter part of June, and the worms grow to their full size by the end of the season, and will be found during the winter and spring, lying in the inner layers of the bark, in a small oval flattened cavity which is usually at the larger end of the track which they have travelled." (Fitch).

I have taken this species on the red oak, at Montreal, quite commonly.

6. THE APPLE FLAT-HEADED BORER, *Chrysobothris femorata*, (Fabr.) ORDER COLEOPTERA ; FAMILY BUPRESTIDÆ :—

The larvæ belonging to this family present an appearance somewhat resembling a tadpole, (Fig. 39, *a*. and *c*.) the second segment behind the head being enormously en-



FIG. 39.

larged, while the remaining segments are much smaller. The species under consideration bores under the bark and in the sapwood of various trees, the apple and white oak in particular.

"The beetle (*d*) measures from four to five tenths of an inch in length"; it is of a greenish black color, polished and shining, with the surface rough and uneven. The head and sometimes the thorax and the depressed portions of the elytra are of a dull coppery color. The elytra or wing-covers present a much more rough and unequal surface than any other part of the insect. Three smooth and polished raised lines extend lengthwise on each wing-cover and the intervals between them are in places occupied by smaller raised lines, which form a kind of network, and two impressed transverse spots may also be discerned more or less distinctly, dividing each wing-cover into three nearly equal portions. The under surface of the body and the legs are brilliant coppery." (Fitch).

Bores in the white (and probably other species of) oak, also in apple and peach trees.

7. THE RED OAK FLAT-HEADED BORER, *Chrysobothris dentipes*. (Germar.) ORDER COLEOPTERA ; FAMILY BUPRESTIDÆ :—

Very closely resembles the preceding species but is smaller. I found it common on red oak in the early part of June, very active, and taking wing readily when alarmed.

8. THE NOR...
FAMILY BRENTHID

This curious...
with darkish brow...
or neck is smooth...
nearest the head...
eral form, most w

quarter to over h...
represents the inse

The female bo...
her beak. It requi...
time the puncture i...
in extracting her be...
and by pressing his...
serving as a fulcrum...
male uses her anten...
antennæ being fur...
strange male appr...
other is thrown fro...
R. Howard in Rile...
the solid wood.

9. THE GRA...
FAMILY CURCULION

"A little pal...
short, broad and sli...
thorax, between wh...
of light grey on the...
short oblique bran...
the others. The le...
larva lives in the t...
last of May or begi

10. THE OAK...
FAMILY CURCULION

Dr. Packard s...
stages under the b...
body punctured, th...
brown, with whitish

11. THE WHITE OAK PHYMATODES, *Phymatodes variabilis*, (Fabr.) ORDER, COLEOPTERA; FAMILY, CERAMBYCIDÆ.

"Boring the trunk and branches of the oak, a narrow longicorn larva, changing to a reddish thick-bodied longicorn beetle."--(Packard.)

Length about half an inch, body and legs reddish, head black, wing-covers Prussian blue.

Dr. Packard states that numerous specimens of this beetle were taken by Mr. Alfred Poor from a white oak stick, June 20th.

12. THE WHITE HEADED PHYMATODES, *Phymatodes varius*, (Fabr.) ORDER, COLEOPTERA; FAMILY, CERAMBYCIDÆ.

"A long-horned beetle, 0.25 in length or slightly less, and about a third as broad, somewhat flattened, clothed with fine erect grey hairs, its wing-covers with two distinct slender white bands which do not reach the suture, the anterior one more slender than the hind one and curved; the antennæ and slender portions of the legs usually chestnut colored. Several specimens of this beetle were met with the last of May, in the trunk of a black oak, in which it is probable their younger state had been passed."--(Fitch.)

Dr. Packard states that he found near Providence, several of these beetles of both sexes, running in and out of a pile of oak cordwood in the forest, May 30th, which was cut the previous winter.

INJURING THE ROOTS.

13. THE ZEBRA LEPTURIAN, *Leptura zebra*, (Olivier.) ORDER, COLEOPTERA; FAMILY, CERAMBYCIDÆ.

Length about half an inch, general color bright golden yellow, upper surface of thorax marked with a transverse crescent shaped spot of black. Wing-covers black, crossed by four yellow bands, under surface yellow, legs and antennæ red.

I took a number of these beautiful longicorns on or about the same red oak on which *A. fulminans* was so abundant. They were very shy and active, taking flight on the least alarm, so that it was difficult to watch an individual for any length of time. The bank of turf and earth torn up by the matted roots, appeared to be especially attractive to them, as most of those taken were found there. On two occasions I observed females entering cavities where the earth had been worn away from the roots, but they followed their windings too far down to allow me to see what they were about. Their actions led me to believe that they oviposit on the larger roots; when disturbed they ran out and flew away. According to Dr. Packard, Dr. Horn states that the larva and pupa inhabit the black oak, injuring the branches.

14. THE OAK PRUNER, *Elaphidion villosum*, (Fabr.) ORDER, COLEOPTERA; FAMILY, CERAMBYCIDÆ.

This insect has been given its popular name on account of the manner in which the grub or larva cuts away the wood of the branch in which it is boring, thus weakening it so that it is liable to be broken off by the autumn winds. The earlier writers on this insect were of the opinion that "The limb thus wounded would become too dry for the maintenance of the soft-bodied larva, hence, it must be felled to the ground, where in the wet and under the snows of winter, it would remain sufficiently moist for the existence of the insect, which completes its transformations within." The investigations of Messrs. Clarkson and Hamilton have shown that moisture is not necessary for the development of the beetle. These gentlemen having obtained numerous specimens from branches kept within doors.

No doubt the pruning of the branch is instinctively done in order to stop the flow of sap, and thus obtain a supply of dead wood; the same end is obtained by the hickory borer, *Oncideres cingulatus*, but in a different manner; in this case the girdling or pruning being done by the adult insect, and from the outside of the branch.

The mature insect wing-covers more or less length from 8 to 12, having it longer and more elongate, while of the same form, but in some, more or less evide

0.60, and is then 0.60 neck backwards, the fleshy grub, somewhat its head which is sn writers on this insect a leaf stock, or of tunnels its way do so that it breaks o

Dr. Hamilton period of metamorphosis four or more years. When first examined wood under the bark dust. Their growth scarcely more than inches during the year summed the wood for ejecting their castings obliquely an oval hole larva then packs the interior of the hole which it lies after spent in the pupal stage of the appearance (till March, contained that I observed to such as had presumed the first two weeks

Mr. T. C. Clarkson "These oak pruners in the season of 1871 to the ground. I nearly full grown, in

The mature insect (fig. 41) is a slender elongated, dark brown, long horned beetle, the wing-covers more or less marked with grey spots. Dr. Hamilton states that they vary in length from 8 to 18 m. m.; in pubescence some being nearly naked and uncolored, others having it longer and condensed into spots or almost vittate, some being quite slender and elongate, while others are short and broad; the surface of the elytra is mostly uniform, but in some, especially such as are narrow and elongated, one or two costæ are more or less evident. Dr. Fitch states that "The larva (fig. 42) grows to a length of



FIG. 41.



FIG. 42.



FIG. 43.

0.60, and is then 0.15 across its neck where it is broadest. It tapers slightly from its neck backwards, the hind part of its body being nearly cylindrical. It is a soft or fleshy grub, somewhat shining and of a white color, often slightly tinged with yellow, its head which is small and retracted into the neck, being black in front." The earlier writers on this insect state that the parent beetle deposits an egg close to the axil of a leaf stock, or of a small twig near the extremity of a branch, and that the grub tunnels its way downwards into the branch, when half grown gnawing away the wood so that it breaks off with the wind.

Dr. Hamilton who has bred numbers of this species states that "The normal period of metamorphosis is three years, but in individuals it may be retarded to four or more years. How the larva got under the bark could not be ascertained. When first examined in April, they were from 4 to 5 m. m. long. They ate the wood under the bark, following its grain, and packed their burrows solidly with their dust. Their growth and progress were both slow, for by the next April they had scarcely more than doubled in length, and had not travelled more than from four to six inches during the year; but after July they developed an enormous appetite, and consumed the wood for at least one inch in length, and often entirely around the limb. Ejecting their castings through holes made in the bark. When full fed they bore obliquely an oval hole into the wood, penetrating it from four to ten inches. The larva then packs the opening with fine castings, and enlarges a couple of inches of the interior of the burrow by gnawing off its sides a quantity of coarse fibre, in which it lies after turning its head to the entrance (as shown in fig. 43). The time spent in the pupal state is indefinite, and does not seem to concern greatly the time of the appearance of the beetle. Sticks split open at different periods from December till March, contained larva and pupa about equally, but no developed beetles. A larva that I observed to go into the wood in April appeared as a beetle among first of such as had presumably pupated in the fall. The most of the beetles appeared during the first two weeks of June, though individuals occurred occasionally till September."

Mr. T. C. Clarkson who has bred this beetle from oak, speaks of it as follows: "These oak pruners were very abundant in Columbia County, this state (New York), in the season of 1878. The September winds brought showers of twigs and branches to the ground. I examined many of them, and found such to contain the larva nearly full grown, in tunnels measuring from ten to fifteen inches long. I gathered

(Fabr.) ORDER,
larva, changing to
wing-covers Prussian
green by Mr. Alfred

(Fabr.) ORDER,

a third as broad,
with two distinct
more slender than
usually chestnut
gray, in the trunk
red."—(Fitch.)

beetles of both
30th, which was

COLEOPTERA;

surface of thorax
black, crossed by

oak on which
light on the least
me. The bark
highly attractive to
observed females
roots, but they
about. Their
turbid they ran
larva and pupa

TERA; FAMILY,

er in which the
weakening it so
writers on this
ne too dry for
to the ground,
sufficiently moist
"The investi-
ot necessary for
orous specimens

o stop the flow
by the hickory
ling or pruning

five goodly sized branches just after they had fallen, for the purpose of illustrating the burrows in my cabinet of nest architecture. The branches remained on a table in a room having very nearly the conditions thermometrically of the temperature without, until the early part of November, when I opened them for the purpose already stated. I was astonished to find that every burrow contained the beetle. The transformation therefore from the larva to the imago was completed in less than eight weeks." Mr. Clarkson repeated the experiment the following season, collecting in October seven branches that had been pruned by the same insect. The imagoes appeared on the following days: November 14th, 22nd, 26th, 29th, December 9th and 26th, all females. "As the imagoes appeared they were examined and replaced in their tunnels, where they now remain in a passive state, and are not likely to exhibit their natural activity until next May or June."

From these accounts it will be seen that the insects inhabiting the oak differ somewhat in habit from those found in hickory; the former completing their transformations in the fall, while the latter passed the winter either as larva or pupa. Continued observations will be necessary to determine if such is always the case, and to clear up other doubtful points in the history of this curious insect. Although called the oak pruner, it is not confined to that tree, as it also attacks chestnut, apple, plum, etc,

15. THE SEVENTEEN YEAR CICADA, *Cicada Septemdecim*, Linn. ORDER HEMIPTERA; FAMILY CICADARIA.

This insect when mature (Fig. 44, c) "is of a black color with transparent wings and wing-covers, the thick anterior edge and larger veins of which are orange red, and near the tips of the latter there is a dusky zigzag line in the form of the letter W; the eyes when living are also red; the rings of the body are edged with dull orange, and the

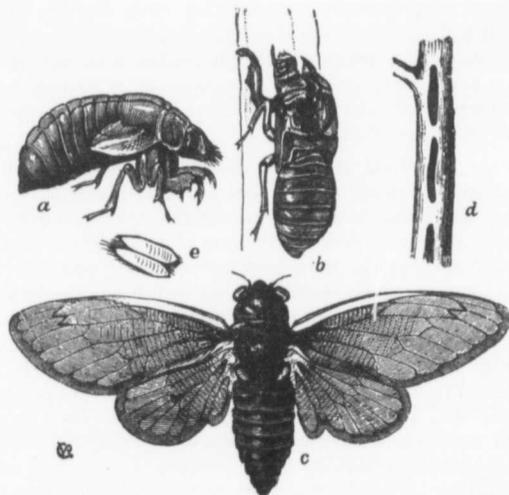


FIG. 44.

eggs are of the same colour. The wings expand $2\frac{1}{2}$ to $3\frac{1}{4}$ inches."—(Harris.) The female is provided with an awl shaped ovipositor or piercer, consisting of "two sharp saws which work alternately, and a central supporting dorsal piece which holds them in their place and strengthens them."

After pairing the females proceed to prepare a nest (Fig. 44, d) for the reception of their eggs. "They select for this purpose branches of a moderate size, which they clasp on both sides with their legs, and then bending down the piercer at an angle of about forty-five degrees they repeatedly thrust it obliquely into the bark and wood in the direction of the fibres, at the same time putting in motion the lateral saws, and in this

way detach little splinters which they cover to the perforation enlarged by a repetition of the same sufficient extent to receive the egg as a groove to convey it to the side, but separated from the wood by a thin film. When thus placed, the insect drops two more times, and fills the fissure from the top side, and begins to make a new nest in five or six minutes in preparing to make fifteen or twenty more, extending along in a line, and then apparently the

After one limb is exhausted, the insect, having laid its eggs, is exhausted, and the hole of an inch through the wood has a pearl-white color. The hole is long, and is of a yellowish color, and is covered with little scales, more than the parent insect. The hole is large, shaped almost like a horn, and the shoulders are little protruding. (Harris.)

As soon as the hatchling is ready, it buries itself in the earth.

"The larva (Fig. 44, a) where pervade the forest, consisting of the moist earth, or snout is provided with a tube from the tube of the earth, and moisture. This is its mode of life. (Dr. Smith in *Prairie*) The female oviposits in many other young trees, as the foliage of an orchard of the best kind, not only in selecting the trees, but years to partake of the fruit. (Cicadas) during the summer look at them one would think the bark of every tree.

Various applications have been made the females depositing their eggs in the morning and in the evening, and in the warmer parts of the day, and they do so eagerly. Although Cicada appears to be common, it is not observed in the Province.

16. THE WHITE-LIMBED CICADA, *Cicada Leucosticta*, Linn. ORDER HEMIPTERA; FAMILY MEMBRACIDAE.

This insect is about the size of a short obtuse horn, extending a line on the back, extending to the tip. Common on oak trees in

way detach little splinters of the wood at one end so as to form a kind of fibrous lid or cover to the perforation. The hole is bored obliquely to the pith and is gradually enlarged by a repetition of the same operation till a longitudinal fissure is formed of sufficient extent to receive from ten to twenty eggs. The side pieces of the piercer serve as a groove to convey the eggs into the nest, where they are deposited in pairs, side by side, but separated from each other by a portion of woody fibre, and they are implanted into the limb somewhat obliquely, so that one end points upwards. When two eggs have been thus placed, the insect withdraws the piercer for a moment and then inserts it again and drops two more eggs in a line with the first, and repeats the operation till she has filled the fissure from one end to the other, upon which she removes to a little distance and begins to make another nest to contain two more rows of eggs. She is about fifteen minutes in preparing a single nest and filling it with eggs, but it is not unusual for her to make fifteen or twenty fissures in the same limb, and one observer counted fifty nests, extending along in a line, each containing fifteen or twenty eggs in two rows, and all of them apparently the work of one insect.

After one limb is thus stocked, the Cicada goes to another, and passes from limb to limb, and from tree to tree, till her store, which consists of from four to five hundred eggs, is exhausted. The eggs (Fig. 44, *e*) are one-twelfth of an inch long and one-sixteenth of an inch through the middle, but taper at each end to an obtuse point, and are of a pearl-white color. The young insect when it bursts the shell is one-sixteenth of an inch long, and is of a yellowish-white color, except the eyes and claws which are reddish, and is covered with little hairs. In form it is somewhat grub-like, being longer in proportion than the parent insect, and is furnished with six legs, the first pair of which are very large, shaped almost like lobster claws, and armed with strong spines beneath. On the shoulders are little prominences in place of wings, and under the breast is a long beak for suction." (Harris.)

As soon as hatched the young Cicada lets itself fall from the limb and immediately buries itself in the earth, burrowing by means of its mole-like fore feet.

"The larva (Fig. 44, *a*) obtains its food from the small vegetable radicles that everywhere pervade the fertile earth. It takes its food from the surface of these roots, consisting of the moist exudation (like animal perspiration), for which purpose its rostrum or snout is provided with three exceedingly delicate capillaries or hairs which project from the tube of the snout, and sweep over the surface gathering up the minute drops of moisture. This is its only food. The mode of taking it can be seen by a good glass."—(Dr. Smith in *Prairie Farmer*.) The females appear to prefer oak and hickory, but will oviposit in many other trees and shrubs, sometimes causing serious injury, especially to young trees, as the following extract from the *Valley Farmer* will show: "We planted an orchard of the best varieties of apple trees last spring. We had taken particular pains, not only in selecting the best varieties, but in planting the trees, and hoped in a few years to partake of the fruit. But our hopes were destined to be blasted. The locusts (Cicadas) during the summer destroyed nearly all of them; not one in six is living. To look at them one would think that some one had been drawing the teeth of a saw over the bark of every tree."

Various applications have been tried on the trees, but without appearing to prevent the females depositing their eggs; but numbers of the insects may be crushed in the early morning and in the evening, as at these times they are not nearly so active as during the warmer parts of the day, and when issuing from the ground hogs and poultry devour them eagerly. Although included in our lists of Canadian insects, the seventeen year Cicada appears to be very rare in Canada, and so far as known to me has not been observed in the Province of Quebec.

16. THE WHITE-LINED TREE HOPPER, *Thalia univittata*. (Harris). ORDER HEMIPTERA; FAMILY MEMBRACIDAE.

This insect is about four-tenths of an inch in length, the thorax is brown, has a short obtuse horn, extending obliquely upwards from its forepart, and there is a white line on the back, extending from the top of the horn to the hinder extremity.—(Harris.) Common on oak trees in July according to Harris.

INJURING THE LEAVES.

17. THE TENT CATERPILLARS, *Clisiocampa distria*, Hubnr, and *C. Americana*, Harris. ORDER LEPIDOPTERA; FAMILY BOMBYCIDÆ.

As these insects have been already described and figured in this report, a detailed description is unnecessary (see Figs. 1-5). Unfortunately both species are only too common, *C. distria* chiefly affecting forest trees, *C. Americana* being most abundant in the orchard and garden. Neither species is very particular in its choice of food plant, feeding voraciously on the leaves of many kinds of trees and shrubs; indeed, both species may often be seen clustered together in groups upon the trunks and larger limbs. The caterpillars resemble each other very closely, but may easily be distinguished by *C. distria* having a row of oval white spots along the back, while *C. Americana* has a white stripe on the upper surface. The reddish brown moths appear in July, and soon deposit their eggs in rings on the smaller branches and twigs, each cluster containing from two to three hundred eggs! A surprising point in the life-history of these insects is that about a month after the eggs are laid the young caterpillar is fully formed inside the egg and remains in this condition all through the winter, only eating its way out from the egg in the following spring, when the leaves expand.—(Fletcher.)

During the winter months, when the trees are bare of leaves, the clusters of eggs should be collected and burnt. The trees should be searched again in spring, just as the buds are opening, when the small white webs in which the young caterpillars shelter themselves may be easily found and destroyed.

An invasion from neighbouring trees can be prevented by tying a strip of cotton-batting round the trunk, which the caterpillars have difficulty in climbing over.—(Fletcher.)

18. THE ORANGE STRIPED OAK CATERPILLAR, *Anisota senatoria*, Hubn. ORDER LEPIDOPTERA; FAMILY BOMBYCIDÆ.

The caterpillar of this moth measures about two inches in length; it is black, with four yellow stripes along the back, and two on the sides; it is armed with sharp prickles or spines, and on the top of the second segment are two long slender spines that project forward like horns. The caterpillars are social, feeding together in swarms on the white and red oak, sometimes almost stripping the trees. When full grown they enter the ground, where they change to chrysalis, the moths emerging the following summer. It has been taken in the neighbourhood of Montreal by Mr. P. Knetzing, and has been observed at Hull, Ottawa, by Mr. W. H. Harrington, and is, I believe, common in some parts of Ontario.

19. THE LEAF-ROLLING WEEVIL, *Attelabus bipustulatus*, Fabr. ORDER COLEOPTERA; FAMILY ATTELABIDÆ.

This beetle measures a little over one-eighth of an inch in length; it is of a blue-black colour, with a red spot on the shoulder of each wing cover. This beetle has the curious habit of rolling up a leaf, trimming and tucking in the lower ends with her beak. The egg is first deposited near the tip of the leaf, and a little to one side; the blade of the leaf is then cut through on both sides of the mid-rib, about an inch and a half below a row of punctures on each side of the mid-rib of the severed portion, which facilitates folding the leaf together, upper surface inside, after which the folded leaf is tightly rolled up from the apex to the transverse cut, bringing the egg in the centre; the concluding operation is the tucking in and trimming off the irregularities of the ends. A few days after completion the cases, first observed the latter part of April, drop to the ground; by May 15 several larvæ hatched and fed on the dry substance of their nests; and by the end of May they pupated within the nest. This state lasted from five to seven days, the first beetles issuing by June 2, while a second brood of larvæ may be found early in July.—(Martfelt.)

20. THE ACORN CURCULIONIDÆ.

The larva of the acorn curculionidæ is a short, stout, blackish larva, when full grown, it cuts deep, then burrows in the wood of the acorn, like the beetle, obscurely marked.

21. THE ACORN TINEIDÆ.

The acorn tinea is a fitting abode for the acorn tinea, it provides her with a chamber within the acorn. The larva has a light brown head, marked with reddish spots.

The following

Papilio turnus, Lin
Limenitis ursula, F
Limenitis dissippus
Thecla calanus, Hu
Thanaos brizo, Bois
Thanaos ennius, Scf
Phryganidea Califor
Halesidota maculat
Orgyia gulosa, Edw
Parorgyia Clintonii
Phobetron pithecium
Euclea monitor, Pa
Euclea querceti, H.
Euclea quercicola, I
Edema albifrons, Sn
Nadata gibbosa, Sm
Anisota stigma, Hu
Anisota pellucida, I
Telea polyphemus, I
Hyperchiria io, Fat
Hemileuca maia, Df
Gastropacha Califor
Heterocampa pulve
Clisiocampa Califor
Clisiocampa constricta
Cosmia orina, Guen
Catocala ilia, Crame
Catocala coccinata, C
Paraphia unipuncta
Aploides mimosaria
Stenotrachelys approx
Endropia bilinearia,
Endropia pectinaria,
Metanoma querciver
Nematocampa filament
Therina endropiaria,
Also about fifty species

INJURING THE ACORNS.

20. THE ACORN WEEVIL, *Balaninus rectus*, Say. ORDER COLEOPTERA ; FAMILY CURCULIONIDAE.

The larva of this beetle lives in the acorns of the red (and probably other kinds of) oak ; it is a short, stout, footless grub, of a whitish color. In the fall, by which time it is full grown, it cuts a circular hole in the side of the acorn, through which it escapes ; it then burrows in the earth, emerging the following season as a small, long-snouted, brownish beetle, obscurely mottled with spots of a lighter color. Common in Canada.

21. THE ACORN MOTH, *Holococera glanduella*, Riley. ORDER LEPIDOPTERA ; FAMILY TINEIDAE.

The acorns that have been deserted by the weevil are selected by this little moth as a fitting abode for her offspring, and the little hole so nicely cut by the grub of the beetle provides her with a convenient opening, by means of which she is able to deposit an egg within the acorn. From this egg hatches a tiny, slender, grayish-white caterpillar, with a light brown head, and blue-black marks on the upper surface. The moth is silvery gray, marked with reddish brown ; the hind wings darker grayish brown.

The following insects also live on the oak :—

- | | |
|---|--|
| Papilio turnus, Linn. | } Given as feeding on oak by Packard. |
| Limenitis ursula, Fabr. | |
| Limenitis dissippus Linn. | |
| Thecla calanus, Hubn. | |
| Thanaos brizo, Bois & Leconte. | |
| Thanaos ennius, Scudder. | |
| Phryganidea Californica, Packard. | (Destructive to oaks, H. Edwards.) |
| Halesidota maculata, Harris. | (On oak, Saunders.) |
| Orgyia gulosa, Edwards. | (Edwards in Papilio I, p. 61.) |
| Parorgyia Clintonii, Grote and Robinson. | Coquillet in Can. Ent. xii, 44. |
| Phobetron pithecium, Smith and Abbot. | (Bred from oak, Lintner.) |
| Euclea monitor, Packard. | |
| Euclea querceti, H. S. | |
| Euclea quercicola, H. S. | |
| Edema albifrons, Smith and Abbot. | (Harris correspondence, p. 304.) |
| Nadata gibbosa, Smith and Abbott. | (Harris correspondence, p. 308.) |
| Anisota stigma, Hubn. | (On oak, Riley.) |
| Anisota pellucida, Hubn. | (On different species of oak, French.) |
| Telea polyphemus, Linn. | |
| Hyperchiria io, Fat. | |
| Hemileuca maia, Drury. | (On oak, Riley, Lintner.) |
| Gastropacha Californica, Packard. | (On oak, <i>Quercus agricoles</i> , H. Edwards.) |
| Heterocampa pulvereana, Grote and Robinson. | (On red and scarlet oaks, French.) |
| Clisiocampa Californica, Packard, | (on oak, Stretch.) |
| Clisiocampa constricta, Stretch | (On <i>Quercus sonomensis</i> , Benth. Stretch.) |
| Cosmia orina, Guen. | (On oak, Saunders.) |
| Catocala ilia, Cramer, | (On oak, Saunders.) |
| Catocala coccinata Grote, | (Coquillet in Papilio I. p. 56.) |
| Paraphia unipunctaria, Haworth, | (On oak, Fitch.) |
| Aplodes mimosaria Guen. | (On oak, Walsh.) |
| Stenotrachelys approximaria, Guen. | (On oak, Abbot.) |
| Endropia bilinearia, Packard. | (On oak, Packard.) |
| Endropia pectinaria, Guen. | (On oak and poplar, Abbot.) |
| Metanoma querciveraria, Guen. | (On oak, Packard.) |
| Nematocampa filamentaria, Guen. | On oak, Thorn, &c. |
| Therina endropiaria, Packard. | |

Also about fifty species of Micro-Lepidoptera.

5 (EN.)

COLEOPTERA.

- Romaleum atomarium, Drury. (In dry twigs of *Quercus virens* in Florida, Schwarz.)
 Elaphidion murcronatum, Fabr. (Same as preceding species.)
 Tragidion fulvipenne, Say. (Bores in oak, Riley.)
 Acanthoderes 4-gibbus, Say. (In dead twigs of oak, Schwarz.)
 Bostrichus bicornis, Web. (Under bark of white oak posts, McBride.)
 Synchrona punctata, Newman. (In rotten oak stumps, Horn.)
 Centronopus calcarata, Fabr. (In black oak stumps, Horn.)
 Centronopus anthracinus, Knoch. (Same as preceding species.)
 Coscinoptera dominicana, Fabr. (In oak, Riley.)
 Mordella 8-punctata, Fabr. (In old oak stumps, Riley.)

HEMIPTERA.

- Eriosoma querci, Fitch.
 Lecanium quercifex, Fitch.
 Lecanium quercitronis, Fitch.

The oak is also attacked by many species of hymenopterous gall-flies, which distort and disfigure the twigs, buds and leaves, forming swellings and protuberances of various shapes and sizes. The flies which produce these galls are very small, and are generally of a black color, with red or yellow legs.

CREATURES THAT AFFECT THE FARMER THROUGH HIS LIVE STOCK.

REV. THOMAS W. FYLES, SOUTH QUEBEC.

PART I.—INSECT PESTS.

PART II.—ENTOZOIC PESTS.

I.

"Round Mount Alburnus, green with shady oaks,
 And in the groves of Silarus, there flies
 An insect pest (named *Ostrus* by the Greeks,
 By us *Asilus*): fierce with jarring hum
 It drives, pursuing the affrighted herd
 From glade to glade; the air, the woods, the banks
 Of the dried river, echo their loud bellowing."

—VIRGIL, GEORGICS III.

HORSE-FLIES (TABANIDÆ).

Kirby and Spence, in Letter V. of their very interesting *Introduction to Entomology*, speaking of the Tabanidæ say:—"In North America vast clouds of different species—so abundant as to obscure every distant object, and so severe in their bite as to merit the appellation of burning flies—cover and torment the horses to such a degree as to excite compassion even in the hearts of the pack-horsemen. Some of them are nearly as big as humble-bees; and when they pierce the skin and veins of the unhappy beast make so large an orifice that, besides what they suck, the blood flows down its neck, sides and shoulders till, to use Bartram's expression, "they are all in a gore of blood." Packard in his valuable *Guide to the Study of Insects*, page 394, confirms this statement, saying of *Tabanus lineola*, "This fly is our most common species, thousands of them appearing during the hotter parts of the summer, when the sun is shining on our marshes and western prairies; horses and cattle are sometimes worried to death by their harrassing bites."

Upwards of eighty species of the genus *Tabanus* are found in North America, and the names of thirty-two of these are on the Toronto Natural History Society's list. The

allied genus *Chrysops atratus*, the Black Ho in length of body and

Tabanus lineola, the l the abdomen. It m formidable arrange me are those that are to l

Wood in his *Ins* hint as to the way of from the bites of the behind his ears filled "At length I discove these and other insect paraffin and rubbed it my gloves, and took s began to decrease in s distance the well-kno without flinching. T eighteen inches from like an arrow. Two until at last it flew of

This is a small house-fly, but is very are brown. Its thore yellow, dotted with conspicuous brown p fiercely. It particula would save the horse

The Horse-tick i more to be dreaded. horse; and it render

No doubt the thi protectives against th

allied genus *Chrysops* has also many species. The largest of our horse-flies is *Tabanus atratus*, the Black Horse-fly. (Fig. 45.) A specimen of this now before me is one inch in length of body and two inches in expanse of wings. It is one coloured, brownish-black,

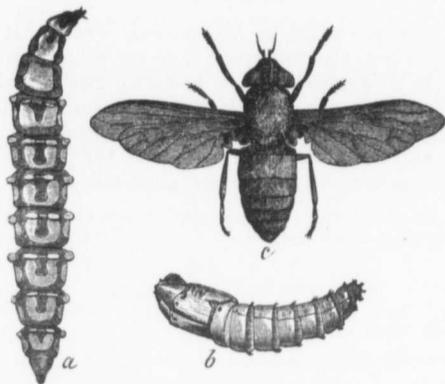


FIG. 45.

Tabanus lineola, the Lined Tabanus, is of a greyish-brown, and has a whitish line along the abdomen. It measures about an inch in expanse of wings. Its proboscis is a formidable arrangement of the maxillæ and other mouth organs. The female horse-flies are those that are to be dreaded; the males do not bite.

Wood in his *Insects at Home*, page 615, speaking of *Tabanus bovinis*, gives us a good hint as to the way of dealing with the horse-flies generally. After telling of his sufferings from the bites of these creatures—of returning to his lodgings with the whole space behind his ears filled with clotted blood from the wounds inflicted upon him, he says:—“At length I discovered a plan which enabled me to enjoy comparative immunity from these and other insect pests. Before starting for the forest I dipped a little sponge in paraffin and rubbed it over my hands, face and neck. I also put some of the liquid into my gloves, and took a little bottle with me so that I might renew it as soon as the odour began to decrease in strength. Thus armed I went into the forest, and hearing in the distance the well-known trumpet charge of the Breeze Fly, determined to await the insect without flinching. The creature drove fiercely at my face until it was within a foot or eighteen inches from me, when it came within the vapour of the paraffin and darted off like an arrow. Two or three times it tried the assault, and as often had to check itself, until at last it flew off in disgust and did not return.”

STOMOXYS CALCITRANS.

This is a small fly belonging to the family MUSCIDÆ. It is about the size of the house-fly, but is very different from it in many respects. Its face is yellow and its eyes are brown. Its thorax is yellow, striped above and below with black, and its abdomen yellow, dotted with brown. Its wings have the front edge and the tip brown, and a conspicuous brown patch in the middle. The creature has a sharp proboscis and bites fiercely. It particularly affects the horse's ears. Probably paraffin rubbed on the ears would save the horse many a pang.

HIPPOBOSCA EQUINA.

The Horse-tick is happily far less abundant than *S. calcitrans*, but its attacks are more to be dreaded. It delights to get under the tail, or between the hind legs of the horse; and it renders the animal furious by the irritation caused by its beak and claws,

No doubt the thick hairy coat, the mane and the tail of the horse were designed as protectives against the attacks of injurious insects; and those who have noticed how

Horses stand in the pasture, nose and tail together for mutual protection, will understand the cruelty of "clipping" and "docking."

THE SHEEP-TICK (*Melophagus ovinus*).

The Sheep-tick is closely related to *H. equina*. Though it is ranked with the DIPTERA or *Two-winged Flies*, the Sheep-tick has no wings. Unlike other Diptera, moreover, its abdomen has no segments—it is a membranous sack. The insect is in many respects a very remarkable one. It produces an offspring almost as large as itself, and that not in the egg, but in the *pupa*. This pupa is soft and white at first, but its case soon turns brown and hardens. At the front of the pupa is a notch marking the lid. This lid in due time opens to let the perfect insect escape.

Thorough washing, close shearing, and the application of a decoction of tobacco, are the approved measures against this intruder.

THE BOT FLIES (OESTRIDÆ).

The Bot-fly of the Horse (*Gastrophilus equi*).

The Bot-fly of the Ox (*Hypoderma bovis*).

The Bot-fly of the Sheep (*Oestrus ovis*).

Who does not know the Bot-fly of the horse? Who has not admired the perseverance with which the creature accompanies the horse for miles, hovering around its chest and fore-legs, and the skill with which it darts in at a favourable moment, protrudes its ovipositor and glues an egg to a hair of the animal?

The eggs deposited by the bot-fly are ready to hatch in four or five days. The horse licks itself, and its wet tongue comes in contact with the eggs. They burst, and the active maggots adhere to the tongue, and are afterwards taken with the saliva into the stomach of the animal. Here they fasten themselves by means of the hooks with which their heads are furnished. They are nourished by the juices of the stomach. When full grown they are voided and drop to the ground, in which they bury themselves. They then pass into the pupal state, and in about six or seven weeks the new bot-flies appear.

To prevent mischief from *G. equi*, let the horse wear a net; groom the animal thoroughly, and make frequent use of the sponge and hot water. Pratt gives the following

REMEDY FOR BOTS.

"Take oil of turpentine 8 oz.; alcohol, 1 quart. Mix and bottle for use. Dose, 4 to 5 oz. in the horse's feed, once a day for eight days, will effectually remove every vestige of bots."—*The Horse's Friend*, page 296.

The Ox Bot fly bores a hole, with her horny and augur-like ovipositor, through the skin of the neck of the ox, and drops an egg therein. The process takes but a few moments, but the ox does not like it. The hole thus made enlarges as the maggot grows, allowing the air to reach the respiratory organs of the parasite. A tumor forms, and from this the creature is at length ejected, to pass the after stages of its existence as in the case of *G. equi*. Young and healthy animals are selected by *H. bovis* as hosts for its young. The perfect insect is black and hairy, and has yellow, white and orange markings. It appears towards the end of summer.

The Sheep Bot-fly deposits its young (for it is ovo-viviparous) in the nostrils of the sheep. The maggot's crawl into the head, and feed on the mucus produced in the maxillary and frontal sinuses. When they are full grown, the sheep blows them from the nose, and they fall to the earth, there to pass into the pupa condition. The fly is of a dirty ash colour, with a brownish thorax. Its hairy abdomen is mottled with yellow and white.

Pine tar rubbed on the noses of the sheep is a preventive to the operations of the insect.

Entozöic pests hitherto been considered fatal both to man and of the most note-wor

The common Ta (body), and a great n both kinds, and is ca they arrive at matur body of the worm, joints become scatte frequently swallows unfiltered water or c thus swallowed emb; remote parts of the brain of man, and embryos begin to ab known as *cysticerci*. the presence of the "measles." Measly When raw or imper measles (*cysticerci*) The bladder-like cas tines, and fastening the mature tape-wor mitted to administer execution ten tape-v the other.

Thus it will be existence of the tap In the case of *Tæni* etc., and the later in the calf or ox, to m *Tænia crassicolis*, sun-fish to the sharl

But of all the said that one-sixth attacks of this creat echinococcus disease which the island ab inhabitants, and pro from the same drea

Of hogs slaugh thirty-seven were fc cause of tape-worm- Osler and Mr. A. W

Hogs should be to roam at large, an

II.

"One talks of mildew and of frost,
And one of storms of hail,
And one of pigs that he has lost
By maggots at the tail."—*Cowper*.

Entozoic pests are more dangerous and more difficult to treat than those we have hitherto been considering. Their operations are obscure, and have in many instances been fatal both to man and beast. It is hoped that the following brief accounts of some of the most note-worthy of these pests will be acceptable.

TAPE WORMS.

The common Tape-worm (*Tenia solium*) consists of a head (which is in reality the body), and a great number of joints (*zooids*), each of which contains sexual organs of both kinds, and is capable of independent life. The tail segments detach themselves as they arrive at maturity, one by one, and are voided by their "host"; whilst, from the body of the worm, fresh zooids are indefinitely produced. The eggs from the voided joints become scattered on the ground, and disseminated in various ways. The pig frequently swallows them with its food. They sometimes find their way (probably in unfiltered water or on raw vegetables) to the stomachs of human beings. From the eggs thus swallowed embryos, or *proscolicæ* escape, and are carried by the circulating fluids to remote parts of the body of the new host. They have been known to penetrate to the brain of man, and to cause epilepsy, and finally death. Obtaining a lodgment, the embryos begin to absorb nourishment and to swell, developing at length into what are known as *cysticerci*. These are bladder-like forms with the heads turned inwards. It is the presence of these in the flesh of the pig that causes the disease known as the "measles." Measly pork splutters in the pan, the cysticerci bursting with the heat. When raw or imperfectly cooked measly pork is eaten by man or other animal, the measles (*cysticerci*) pass into the stomach, and are acted upon by the digestive fluids. The bladder-like case or vesicle succumbs, but the head uninjured passes into the intestines, and fastening itself by means of its sucking appendages, proceeds to develop into the mature tape-worm. Dr. Kuchenmeister, a physician of Zittau, in Saxony, was permitted to administer measly pork to two criminals condemned to death. After their execution ten tape-worms were found in the intestines of one, and nineteen in those of the other.

Thus it will be seen that two hosts are necessary for the completion of the cycle of existence of the tape-worm—the earlier stages are passed in one, the later in another. In the case of *Tenia solium*, the earlier stages are passed in the body of the hog, rat, etc., and the later in man or some inferior animal. *Tenia mediocanellata* passes from the calf or ox, to man or the dog; *Tenia marginata*, from the dog to the hog, etc.; *Tenia crassicolis*, from the mouse to the cat, etc.; and *Tetrarhynchus reptans*, from the sun-fish to the shark, etc.

But of all the tape-worms the most dreadful perhaps is *Tenia echinococcus*. It is said that one-sixth of the deaths among the population of Iceland result from the attacks of this creature, and that there were in the year 1863 ten thousand cases of echinococcus disease in the island. The worm attains to perfection in the dogs with which the island abounds, and its embryos find their ways into the systems of the human inhabitants, and produce the terrible results recorded. In England fatal cases resulting from the same dreadful cause are not unfrequent.

Of hogs slaughtered at the Montreal abattoir "seventy-six in one thousand and thirty-seven were found to be measly—that is, infected by the *cysticercus cellulosæ*, the cause of tape-worm—and thirty-one were found to contain the echinococcus."—Dr. W. Osler and Mr. A. W. Clements, reported in *Montreal Daily Star*, January 13th, 1883.

Hogs should be confined to a vegetable diet and milk. They should not be allowed to roam at large, and to feed on the garbage of slaughter-houses etc. The ordinary

butcher's hog should be held in abomination. Scalding water should occasionally be thrown over the floors of the pig-pen and the dog-kennel. Should a tape-worm be voided by any creature, it should be burned immediately or buried deep in the earth. Dried beef, ham, &c., should not be eaten raw. *All* meat should be thoroughly cooked. Especial care in this respect should be taken with sausages.

TRICHINA SPIRALIS

This parasite was first made known by Prof. Owen, the famous English anatomist in 1835. It was discovered in its encysted condition in human flesh. Prof. Owen found that the gritty calcareous capsules, that had blunted the dissector's scalpel, contained, in every instance, from one to three minute hair-like worms coiled up conically. This circumstance suggested the name of the parasite to him. A German helminthologist, Dr Herbst, by feeding dogs with trichinous meat, and afterwards dissecting them, discovered the way in which the trichinæ are propagated.

The capsules containing trichinæ, having passed into the stomach, are dissolved by the gastric juices, and the worms are set free. The adult male worm is one-twelfth of an inch long, the adult female is one-eighth of an inch. The latter is ovo-viviparous—she brings forth her young alive. These rapidly spread themselves throughout the voluntary muscles, wherein they at length become encysted. In the case of the human host they must ultimately perish—unless, indeed, the unfortunate man be destined to become a missionary, and to make a meal for inhabitants of New Caledonia, or some other nice people.

It is from the pig that danger of trichinous infection is to be dreaded; and the danger is greater perhaps than people are aware of. It has been found that about one in two hundred and fifty of the pigs killed in Montreal have suffered from trichinosis. Such paragraphs as the following, very frequently appear in the newspapers:—

“Henrietta Stræz, of Chicago, ate raw ham at a wedding a month ago, and died on Friday of trichinosis in great agony. Forty thousand parasites were found in a square inch of one of her muscles. A number of other persons who partook of the ham showed evidence of the disease but most of them have been relieved.”—*Montreal Daily Witness*, January 21, 1882.

“Four hundred persons are prostrated by trichinosis in ten villages of Saxony, and fifty-one are hopelessly ill. Deaths from the disease are occurring daily.”—*Montreal Daily Star*, October 17, 1883.

The symptoms of trichinosis or trichiniasis are as follows:—Loss of appetite, nausea, vomiting, diarrhoea, fever and prostration, soreness in the muscles, painful swellings, laboured breathing, etc. The disease in pigs has often been mistaken for “hog-cholera”; in human beings, for typhoid fever.

The means of prevention are the same as against the echinococcus disease.

THE LIVER FLUKE (*Fasciola hepatica*).

The Flukes, unlike the trichinæ and the tape-worms, are not parasitic through all the period of their existence. They spend a portion of the time on land, a portion in the water. The full-grown liver-fluke is about an inch in length, and is pointed somewhat abruptly at the head, but tapers gradually at the other extremity. It is provided with two suckers—the oral for imbibing nourishment, at the extremity of the head; the ventral at the base of the neck, which is used merely as a “holdfast.” The skin of the creature is furnished with numerous microscopic spines. The liver-fluke is found most frequently in *grazing* cattle, and especially in the sheep. The disease it causes is known as the “rot”; and so destructive is it, that, in England, during the season of 1830-31, it was estimated that upwards of 1,000,000 sheep died from it alone. The flukes are sometimes very numerous; Leuwænhœck counted eight hundred and seventy in one liver.

The life-history of the liver-fluke. When sexually mature it inhabits the intestinal canal to various agencies, in running streams, and in this swims about and to this it fastenates the body of rapidly develops in *Cercaria*. These pastures. From that of sheep, cattle, a “host” they bore a length of time. enclosures, and be

The preventive of sheep to the high stock in good condition seem as a rule to be sickly ones.

This parasite thickness of a conical males are smaller. troubled with the to near the end, of the fowl, twist and bring away they be used effectively thoroughly cleaned a little carbolic acid ginger mixed now

The Honey-Eater by the early colonies surrounding the edge for the ever multi By the India

“It is surprising within but a modification the white man, as advances, the Indians (*Prairies*, ch. ix.)

The life-history of the fluke is a very extraordinary one. It is hermaphroditic. When sexually mature it passes from the liver of the sheep, and escapes through the intestinal canal to the open pasture land, where it deposits its thousands of eggs. By various agencies, and especially in wet weather, these eggs are carried into pools, ditches, running streams, etc. From the moistened egg a ciliated embryo, or *proscolex*, escapes. This swims about for a while till it comes upon the soft body of some water-snail or insect and to this it fastens itself. After a time it casts away its ciliated covering and penetrates the body of the creature to which it attached itself. When favourably placed, it rapidly develops into what is called the "nurse" or *Sporocyst*, and produces young called *Cercariae*. These cercariae migrate, swim about in the water, or wander into the moist pastures. From thence they are taken, either in food or drink, into the digestive organs of sheep, cattle, and (sometimes) human beings. From the digestive organs of their "host" they bore their way to the liver, in which they become encysted, and remain for a length of time. At length, having attained a higher organization, they burst from their enclosures, and become converted into the perfect *Fasciola hepatica*.

The preventives against the fluke that have been suggested are, the confining of the sheep to the high pasture-lands that they naturally prefer, frequent salting, keeping the stock in good condition by the use of cut turnips, oil-cake, etc. Well fed, healthy stock seem as a rule to be less open to the attacks of parasites of every kind, than weak and sickly ones.

SCLEROSTOMA SYNGAMUS.

This parasite is the cause of the "gapes" in poultry. It is a small red worm of the thickness of a common pin. The females are half or three-quarters of an inch long: the males are smaller. They infest the wind-pipe of the fowl and cause suffocation. Poultry troubled with them gape, sneeze, and gasp for breath. To relieve them, strip a feather to near the end, dip this in salt-and-water, then slip it dexterously into the wind-pipe of the fowl, twist it around once or twice and suddenly withdraw it. This will dislodge and bring away the worms. It is said that a loop of gut such as is used in fishing-lines may be used effectively for the same purpose. The poultry-house should be frequently and thoroughly cleaned. Wood and coal-ashes should be spread over the floor and occasionally a little carbolic acid should be sprinkled upon it. A little flour of brimstone and ground ginger mixed now and then with warm meal, and fed to the fowls, would be beneficial.

BEE-MOTHS.

REV. THOMAS W. FYLES, SOUTH QUEBEC.

The Honey-Bee (*Apis mellifica*), is not an indigene of America. It was imported by the early colonists; and it soon spread and multiplied exceedingly—the forests surrounding the early settlements affording both sufficient harbourage and abundant food for the ever multiplying swarms.

By the Indians the bee was called the White Man's Fly.

"Wheresoe'er they move, before them
Swarms the stinging fly the Ahmo,
Swarms the bee, the honey-maker."

(*Song of Hiawatha*, ch. xxi.)

"It is surprising in what countless swarms the bees have overspread the far West within but a moderate number of years. The Indians consider them the harbingers of the white man, as the buffalo is of the red man, and say that in proportion as the bee advances, the Indian and the buffalo retire." (Washington Irving: *Tour on the Prairies*, ch. ix.)

And Bryant well sang :—

“The bee,
A more adventurous colonist than man,
With whom he came across the eastern deep,
Fills the savannas with his murmurings,
And hides his sweets, as in the golden age,
Within the hollow oak.”

adding with prophetic voice :—

“I listen long
To his domestic hum, and think I hear
The sound of that advancing multitude
Which soon shall fill the deserts.”
(*The Prairie.*)

Fennimore Cooper, in his stories of *The Prairie and Oak Openings* has given delineations of the men, who, on the outskirts of civilization, made it their business to hunt and plunder the bees.

But a spoiler apparently less formidable, but in reality more dangerous, followed up the bee more closely than did its human foes. This was the Bee Moth (*Galleria cereana*).



FIG. 46.

Fabr) a fellow exile. (Fig. 46 represents all its stages: *a* the full grown caterpillar, *b* the cocoon it spins, *c* the chrysalis, *d* the female moth with open wings, *e* the male with closed wings.) And now, wherever bees are kept upon this continent, there is danger to them from the “Bee Moth.” A few words therefore upon the Bee Moth and its relatives may be interesting to those who have the care of bees.

The bee moths belong to that group of insects called *Pyrilidina*, and to the family *Galleriæ* in that group. Insects of the kind were known to the earliest writers on the subject of bees. Aristotle and Virgil allude to them. The former says that the moths and worms are expelled by the good bees; but that the combs of the idle bees perish. The latter numbers “the moths’ dreadful progeny” among the enemies of the hive.

In England three different bee moths are known belonging to as many different genera, but all in the family *Galleriæ*. They are *Galleria cerella*, *Aphomia colonella*, and *Achoria grisella*. The first and last named are found in the hives of the honey-bee, and the second in humble-bees’ nests. We will take the insects inversely so as to end with the one we are most interested in.

ACHROIA GRISELLA.

Many years ago I had abundant opportunities for observing *Achroia grisella* through all its changes. My accounts of the insect were published at the time in the *Zoologist* and the *Entomological Intelligencer*. The larva of *A. grisella* is about nine lines in length when full fed, and is rather hairy. It is very active, throwing itself vigorously about at the slightest annoyance. Its colour is white with a tinge of pink. The head and second segment are reddish brown. The spiracles are hardly perceptible. The pupa is pale brown, and is enclosed in a white cocoon. It is usually secreted near the entrance under the inside ligaments of the old-fashioned straw hives. The imago is from six to eleven

lines in expanse of satiny gloss. The in the year.

The English in the apiary at the a bee-like motion n guards, and win th do not always succ and torn in pieces the chief danger is the hive. The lar covered ways, shelt the hive to the bro

This enemy of *Guide to the Stud wings. The fore- it is marked with The hind margin is The female moth, the cells of the hu comfiture to the ri*

The moth tha Langstroth’s book Virgil uses the ter it has been applice moth is called *Gal* He says :—“The this insect in cons deceived by the st and to the female confusion, both th stead” (page 500)

Galleria cerea are expanded, abc table. The fore-w roughly squared o able ovipositor, v crevices out of ha

The insect is Boston, cut a fem depositing eggs i which it lay.

There are tw May, and the lat

The larvæ ar they are waxen g *grisella*, they cons that the hairs ser back into their si

*The terminal jo ong, tapering, and s

lines in expanse of wings. Its head is yellow. The body and wings are grey with a satiny gloss. The fore-wings are rounded at the tip. There are two broods of the insect in the year.

The English naturalist who would see *A. grisella* to advantage should take his stand in the apiary at the close of the day. There he may see the female moths hovering with a bee-like motion near the entrances of the hives. Their object is to dart between the guards, and win their way to the interiors. Notwithstanding their amazing agility they do not always succeed in this. I have more than once seen *grisella* seized by the bees and torn in pieces with the utmost fury. When the door of the hive is passed, however, the chief danger is over, and the moth proceeds to lay its eggs in suitable places within the hive. The larvæ as soon as they burst from the egg begin to spin silken tubes or covered ways, sheltering themselves under their work, and pushing it forward through the hive to the brood-comb on which they thrive most.

APHOMIA COLONELLA.

This enemy of the humble-bee is found both in Europe and America (See Packard's *Guide to the Study of Insects*, p. 329). The moth is an inch or more in expanse of wings. The fore-wing is of a pinkish grey, having a tinge of green along the front edge, it is marked with two serrated transverse lines, and between these with two black dots. The hind margin is entire. In the male insect the basal half of the fore-wing is whitish. The female moth, in the month of June, deposits her eggs, in great numbers, amongst the cells of the humble-bees nest; and the larvæ that emerge from them soon bring discomfiture to the rightful owners.

GALLERIA CEREANA.

The moth that is dreaded by the bee-masters of this country is *Galleria cereana*. In Langstroth's book on bees this insect is misnamed *Tinea mellonella*. It is true that Virgil uses the term *tinea* in speaking of the bee-moth; but, since the days of Fabricius, it has been applied to a genus to which the bee-moth does not belong. In England the moth is called *Galleria cerella*; and Wood in "Insects at Home" tells us the reason why. He says:—"The specific name *cerella* (from the Latin word *cera*, wax) has been given to this insect in consequence of the wax-eating propensities of the larva. Linnaeus being deceived by the structure of the palpi* gave to the male the specific name of *cereana*, and to the female that of *mellonella* (from the Latin *mel*, honey). So in order to avoid confusion, both these have been rejected, and the present specific name accepted in their stead" (page 500). By American naturalists, however, the name *cereana* is retained.

Galleria cereana in its perfect state is a brownish moth, measuring, when its wings are expanded, about an inch across. In repose the wings hang down like the sides of a table. The fore-wings are longer than the under-wings, and appear as if they had been roughly squared off. The female has a beak-like formation of the head, and a remarkable ovipositor, which works with a telescopic motion, enabling it to deposit eggs in crevices out of harm's way.

The insect is wonderfully tenacious of life. Langstroth tells us that Mr. Tidd, of Boston, cut a female in two, and the abdomen went on thrusting out its ovipositor, and depositing eggs in some slits which had been made with a pen-knife in the board on which it lay.

There are two broods of *G. cereana* in the year. The former of these appears in May, and the latter in August.

The larvæ are larger and plumper than those of *Achroia grisella*. In appearance they are waxen grubs, having their heads and second segments horny. Like those of *A. grisella*, they construct silken tunnels; and, like them also, are slightly hairy. I imagine that the hairs serve as feelers. At any rate the larvæ are extremely sensitive, darting back into their silken galleries at the slightest touch.

*The terminal joint in the palpus of the male is short and conoid: in the palpus of the female it is long, tapering, and slightly forked at the end.
T. W. F.

A few years ago I laid away, in an unused chamber, a hive, full of comb, that had been vacated by the bees. Examining this hive some time afterwards, I found the comb completely broken down and destroyed. On the bottom of the hive there was an unsightly mass of tangled webs, and fragments of wax, dotted throughout with the black castings of the *cereana* larvæ. The larvæ themselves were gone; but, on examining a heap of pamphlets and newspapers that lay near, I found the leaves stuck together with numerous silken and beautiful white cocoons. From these, in due time, I obtained many perfect specimens of *Galleria cereana*.

The bee-moths delight in ill-constructed hives, in which there are accumulations of old comb. Their presence in any number is a sure sign of weakness in the bees. A hive in which they have well established themselves may be known by its offensive smell.

To banish them the modern hives with moveable frames should be used. Affected comb should be cut away and *destroyed*. It should be remembered that masses of web and broken comb, thrown on the refuse heap, will afford both food and protection to any larvæ that may remain in them, and that, in due time, perfect insects will come forth to invade the hives again.

NOTES ON THE HEPIALIDÆ OF THE PROVINCE OF QUEBEC.

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

The Hepialidæ, in England, are denominated "Swifts," from their peculiarly rapid and oscillating flight. One of their number (*Hepialus humuli*) is called "the Ghost,"—the snow-white wings and hovering motions of the insect having suggested the name.

Our Canadian representatives of the family are few in number, and extremely rare. Three of the four species that have been taken in the Province of Quebec have greater amplitude of wing than most of their British congeners.

Characteristics of the genus Hepialus.

Imago:—Antennæ, filiform and very short. Wings, distant at the base, lanceolate or somewhat falcate. Abdomen, elongate.

Larva:—Naked, elongate. Head and second segment, horny. Feeds at the roots, or in the stems, of plants.

Pupa:—Furnished with short spines on the segments.

Descriptions of Hepialus Moths taken in the Province of Quebec.

Argenteo-maculatus. (Harris.) This fine insect, which is about three inches in expanse of wings, is in colour ash-grey with cloudy markings. The hind wings have an ochreous tinge towards the tips. The silvery spots to which it owes its name are two on each fore-wing. The one nearer the front edge is round; the other is triangular. The insect is described by Harris, in "Insects injurious to Vegetation," page 410. Dr. D. S. Kellicott, of Buffalo, succeeded in raising this species, from larvæ obtained from roots and stems of *Alnus incana* (Can. Ent. vol. xx., p. 233).

Gosse, in the "Canadian Naturalist," (page 248) speaks of *Argenteo-maculatus* (which he names "the Dragon Moth,") as "quite numerous" in the latter part of July in the fields around his residence at Waterville, P.Q. The circumstances in this case must have been very peculiar, for, I think, no one else has found the insect *numerous* in any part of Canada. Gosse found it "dancing from side to side on the wing above the herbage within a space of a yard or two." A female which he pinned ejected small white eggs to a considerable distance with great rapidity. In 1871 I found what I believed to be a pupa of this species in a stem of common alder; but the insect, probably from lack of moisture, perished.

Auratus. (Can. Ent., vol. x. in 1877. It has Ent., vol. xx., p. County, in July, with pale brown a pale golden spo wing, and, near t the insect with a a meadow, on a s

Thule (Stred from a specimen J. Bowles wrote in the possession specimens in coll taken by Mr. W sented to me by the species hove in August, at C

Thule is ab colour. Starting thirds of its leng and projecting fi tangular spots. white spots in d white spot in a the fore-wing, an lines. The frin

Gracilis. the Quebec Hep wings are but s with darker bro to the tip, is a white. The on 1881, resting o

THE

BY AUG.

There is a Harris's style Boston Commo placarded with Boston, Scienc Bostonian shri afflatus. That Boston, sheds from my recol Cambridge wa strange to a w is cosmopolita frutti dish of everything els he tends to lo

Auratus. (Grote). This beautiful moth is very accurately described by Grote in *Can. Ent.*, vol. x., p. 18., from a specimen taken in the Adirondacks by Mr. W. W. Hill in 1877. It has since been taken by Mr. E. P. VanDuzee, at Buffalo, New York (*Can. Ent.*, vol. xx., p. 100). I have a lovely specimen of the insect which I took in Brome County, in July, 1865. It is of a faint purplish tinge. The fore-wings are decorated with pale brown markings and extensive patches like as of dead gold. There are also a pale golden spot, at about one-half the length and one-fourth the width of the fore-wing, and, near the hind margin, three other pale golden spots triangular in form. I took the insect with a net in the dusk of the evening, as it was flitting near the hedge-row of a meadow, on a slope of the "Pine Mountain."

Thule (Strecker) was described and figured by Strecker in "*Lepidoptera*," No. 12, from a specimen sent to him by Mr. Caulfield, of Montreal. In February, 1884, Mr. G. J. Bowles wrote that Strecker's specimen, a specimen in his own possession, and a third in the possession of Mr. J. G. Jack, of Chateaugay Basin, were, he believed, "the only specimens in collections" (*Can. Ent.* vol. xvi., p. 40). Since then the insect has been taken by Mr. W. D. Shaw, and by Mr. H. H. Lyman. The specimen I have was presented to me by the last named gentleman. It was captured in July. Mr. Shaw found the species hovering over and settling upon the Ox-eye Daisy (*Leucanthemum vulgare*), in August, at Cote St. Antoine.

Thule is about two and one-half inches in expanse of wings. It is creamy white in colour. Starting from the base of the fore-wing, and touching the costa for about two-thirds of its length, there is an irregular brownish patch. The costal edge is dark brown, and projecting from this into the brownish patch are three conspicuous dark-brown rectangular spots. On the inner edge of the patch, not far from the base, are two small white spots in dark-brown rings, and on the further extremity of the same edge is a third white spot in a dark brown ring. There are a few other less conspicuous brown spots on the fore-wing, and, towards the hind margin, two slightly scalloped and interrupted brown lines. The fringe on the hind margin is marked with brown spots.

Gracilis. (Grote). This insect, described and figured by Grote, is the smallest of the Quebec Hepialidæ. In expanse of wings it measures one and one-fourth inches. The wings are but slightly feathered. They are of a warm brownish hue streaked and spotted with darker brown. From the inner side of the base of the fore-wing, sweeping round to the tip, is an irregular, pale band. The fringes of the hind wings are brown and white. The only specimen I have of this rare moth was taken at Cowansville, in July, 1881, resting on the under side of a Hoop Boletus (*Boletus ignarius*).

THE RISE OF PRACTICAL ENTOMOLOGY IN AMERICA.

BY AUG. RADCLIFFE GROTE, A. M., VICE-PRES. AM. ASS. ADV. SCIENCE (1878), ETC.

There is another kind of moth found in Massachusetts—and with this echo of Dr. Harris's style of writing repeating itself in my mind, I passed under the elm trees, crossing Boston Common. It needed not to feed my imagination that the trees themselves were placarded with Latin titles; I felt that I was upon scientific and sacred ground. For Boston, Science has not come in vain. Rather does she seem to dwell habitually within Bostonian shrines, leaving the temples to her honour in New York empty of the divine afflatus. That long past July day, its heat tempered by a cool east wind, my first in Boston, sheds its light upon me still, while so many of its fellows have passed in darkness from my recollection. I have never since been down by the Back Bay, or wandered Cambridge ways, *sub tegumine ulmi*, without feeling a particular reverence for the place, strange to a wanderer who has passed through many cities of renown. While New York is cosmopolitan in all its aspects, and its Jews and Gentiles combine to produce a *tutti frutti* dish of American science, Boston has a scientific style of its own, descending, with everything else, from the Puritans themselves. No matter who unfolds there his teaching, he tends to lose some part of his individuality, his thoughts take a local cast, he shapes his

words into sentences of Bostonian ring and emphasis. A mighty spirit pervades the people. Professor Louis Agassiz, a great man, was himself influenced thereby, and lately even Dr. Hagen, still resisting the English language and talking of "educating" a caterpillar, after a quarter of a century in the shadow of Harvard, vaguely feels the spirit of Massachusetts. Recently, and since her last great champion for the old order of nature has passed into the eternal silences, Boston has been occupied in moulding Darwinism preparatory to swallowing it. Already it appears as if home-made, and is ready to deceive the very elect. The earlier notion of the origin of mankind was too much in accordance with the simple vigour of Puritan thoughts to be easily abandoned. Whereas the New Yorker quickly changed his mind as to his line of descent, being in any event unequal to the task of tracing it for any length, Boston had to fit the new ideas to the New England eternities of the "Mayflower" and Bunker Hill before they could find favour in her eyes.

But we live now in an age of anniversaries, of semi-centennials and centennials, and among these we entomologists may find the opportunity of commemorating a New England notion, and he who represented it, Dr. Thaddeus William Harris. It is a sign of increasing thoughtfulness, that, along with the memory of distinguished persons, we celebrate the rising of the ideas by which they were animated. Hero worship has not declined, but there is a clearer idea prevailing as to the value of the heroes and the principles they represented, and, in consequence, some changes in public opinion as to the quality of the heroship itself. And it would appear, that whereas public opinion has declined in its estimation of many temporary celebrities and their causes, it is rising as regards Dr. Harris and the cause he represented. Amid the recent wholesale creation of the office of State Entomologist, fifty years after the publication of the first Report on Injurious Insects, we may indulge in a semi-centennial retrospect, and briefly refer to some of the phases of the progress of the science of entomology in America during this period. Yes, it is Dr. Harris who ran the first furrow, and his successors have but widened the field of practical and economic entomology. Out of the eternal movement of atoms and ideas, the New England notion, sent forth through Dr. Harris (1837-1841), has grown in importance, and the States are generally following the example of Massachusetts. In the Botanical and Zoological Survey of this State, authorized by a resolve of April 12th, Dr. Harris was appointed June 10th, 1837, to report upon the insects. The first short report upon the "Habits of some of the Insects injurious to Vegetation in Massachusetts" (1838), was followed by the well known and fuller "Report on the Insects of Massachusetts injurious to Vegetation" (1841).

It is a relatively small world in which my hero moved, and yet it finds room for differing samples from the great world about it. Its members are held together by their devotion to the study, but are otherwise ill assorted and move reluctantly together. We are all men before we are entomologists. Entomology has its scholars and pedants, its men of good and ill temper, its men of conscience and no conscience, of large and small views, kind and unkind. It is clear as daylight of what sort was Dr. Harris. A plain and earnest man, without either assumption or rawness, worthy of study in all his ways, of most commendable disposition. From his picture we get the impression of a sort of good homeliness, which stands as well in a man as good looks. From his writings we gather the certainty that he was a pleasant, honest gentleman. As it is the soul which builds the body, it is certain that Dr. Harris was all of this. Alas, that there are not more like him. Not only should all the newer State Entomologists take him for an example, but the appointing power, in the exercise of a high discretion, should take Dr. Harris as a standard; should know their man before appointing him, nor be deceived by mere dabblers in the Latin names of insects. Men of talent, of the larger views which come of reading and experience, should be sought, for such do not readily present themselves. Unfortunately the appointing power yields without thought to the importunities of those entirely impressed by their own abilities, self conscious, pushing, selfish persons, who sometimes come in this way to fill a position which a better and more modest man would have adorned. Even in entomologists, those dealers in cosmical smallware, the inequalities of life and character are mirrored.

Thomas Say was
At any rate, he des
all of them. After
mology. Say's wid
no one singly. Bu
Harris gave a fresh
his hands *practical*
whom commences v
sub-divide Say's fie
entomological wave
century in Georgia
beginning of this
before breaking an
are Dr. Leconte an
and Provancher or
Scudder and Thom
the knowledge of g
many hands, *anch*
of insects, that, n
stamp of dilettant
other domains and
carried into public
entomology becom
dilettantism about
Worm Moth (*Alei*
acquaintance on t
this atmosphere of
ward to make one
is to technical en
question which is
science, one might
to celebrate the se
and the natural ir
Walsh, Riley, Le

The example
as in most public
notion" until it r
from Philadelphia
in the sixties, an
ceeded by the lat
pare public sent
of the State of
as well as others
gist, which bega
should answer the
point their State
injurious to Fruit
claims to be plac

But the Sta
the *Cultivator* fe
ture of this State
New York Stat
description of th
Board, Dr. Asa I
effect. A better
his attent on thi
fruit-bearing tre

Thomas Say was, perhaps, the earliest American entomologist of wide reputation. At any rate, he described insects in all the orders, and was, for a time, an authority in all of them. After Say's death there came a pause in the progress of technical entomology. Say's wide knowledge of genera and species in all the orders was inherited by no one singly. But Dr. Harris is not to be reckoned among the successors of Say. Dr. Harris gave a fresh turn, a useful impetus, to the science. Entomology becomes under his hands *practical*, a positive help to agriculture. The real successors to Say, with whom commences what I have called the period of renaissance in American entomology, sub-divide Say's field and the domain falls into many hands. From a wider view the entomological wave passes from south to north. Commencing at the close of the last century in Georgia with Abbot and the elder Leconte, it reaches Pennsylvania at the beginning of this century with Say, and carries Harris in Massachusetts on its crest before breaking and flooding the continent in all directions. The real successors to Say are Dr. Leconte and, afterwards, Dr. Horn on the Coleoptera; Cresson, Bassett, Norton and Provancher on the Hymenoptera; Osten Sacken and Williston on the Diptera; Scudder and Thomas on the Orthoptera; Uhler on the Hemiptera, with others, bringing the knowledge of genera and species into a completer shape. The Lepidoptera falls into many hands, *anch'io son pittore!* There is this about the mere naming and classifying of insects, that, no matter how exactly the work is performed, it carries with it a certain stamp of dilettantism. Only when the scientific knowledge so gained is carried into other domains and made the basis of generalizations upon the laws of life, or when it is carried into public economy and used to further the practical ends of agriculture, does entomology become a serious science. Say's work, with all its merits, has this flavor of dilettantism about it, and he contents himself with giving a brief description of the Cotton Worm Moth (*Aletia argillacea*) and Hessian Fly. But Harris, with a much slenderer acquaintance on the whole with the genera and species of insects, lifts his work out of this atmosphere of dilettantism by the turn which he gives to it, and which is henceforward to make one chief development of entomology in America. Practical entomology is to technical entomology what our everyday language is to Latin. There can be no question which is the more useful. In giving Dr. Harris the credit for this turn of the science, one might enquire into the genesis of the idea itself, but it is sufficient for us to celebrate the semi-centennial of its great incorporator. The successors to Dr. Harris and the natural inheritors of his idea are Saunders and Fletcher in the Dominion; Fitch, Walsh, Riley, LeBaron, Lintner, Comstock, in the States.

The example set by the Legislature of Massachusetts was not quickly followed, and, as in most public matters in America, private enterprise tided over the "New England notion" until it received general official recognition. This private help came principally from Philadelphia where Cresson, Blake and others issued the "Practical Entomologist," in the sixties, and of which periodical I was editor for the first few numbers, to be succeeded by the late Mr. Walsh. These unpaid and unofficial exertions did much to prepare public sentiment, to bring about the present wholesale recognition on the part of the State of the value of entomological researches. From these unofficial sources, as well as others not here mentioned, together with the issue of the *Canadian Entomologist*, which began in 1867, came assistance during the years until the Western States should answer the call of Massachusetts, and Illinois in 1868 and Missouri in 1869, appoint their State Entomologists. Later on Prof. Saunders, in 1883, issued his "Insects injurious to Fruits," of which recently the second edition has appeared, a book which has claims to be placed side by side with the famous treatise of Dr. Harris.

But the State of New York had, in 1854, taken a step in the same direction. In the *Cultivator* for June of that year appeared the following paragraph: "The Legislature of this State (*i.e.* New York) at its late session, placed \$1,000 in the hands of the New York State Agricultural Society to be expended in making an examination and description of the insects of this State injurious to vegetation. At a meeting of the Board, Dr. Asa Fitch of Salem, Washington Co., was appointed to carry this object into effect. A better selection could not have been made, and we learn that he is to devote his attent on this season mainly to the investigation of such insects as depredate upon fruit-bearing trees. His report will be looked for with interest and we doubt not will

prove of great economic and scientific value." So far the *Cultivator*, which evidently meant well to Dr. Fitch, although perhaps expecting more results from "this season" and "\$1,000," than could well be forthcoming from one head and one pair of hands. Those were still the times when a slight halo of conjuring, a flavor of necromancy gathered about the scientist. The recipe seemed to be: Take a good insect wizard, pay him as little as possible, let him loose in the fields, and the bugs will disappear. The State was anxious for practical returns from its investment of "\$1,000." But the *Salem Press* of August 8th, 1854, already saw that there was necessity for more "liberal" funds. In an article, which is as eulogistic of its townsman as the most ambitious Chief Commissioner could require, it says, that "the appointment of Dr. Fitch to carry out the objects set forth, is a very fortunate one for the State; as he is probably more thoroughly acquainted with entomology than any person in the United States. To a scientific and practical knowledge of his subject, he can bring the aid of a ripe scholarship; and should the State be liberal in its appropriations for this object, in the hands of the Doctor, we can look forward, with confidence, to a Work possessing more real value to the Agricultural and Horticultural interests of the Country [the capitals are the *Press's* own] than any that has ever been published." To this effect the *Salem Press*, in its comments on the announcement of the *Cultivator*. How far the Reports of Dr. Fitch to the N. Y. State Agricultural Society met the expectations and merited the praises of the newspapers we shall not here inquire. Mr. Lintner has indexed these Reports. We are here interested in noting the spreading of the "New England Notion" incorporated in Dr. Harris. "Do you take the idea?" asks Massachusetts of New York. It required seventeen years before New York, like a seventeen-year locust, rose to the occasion and appointed Dr. Fitch. When she got the idea she sought for one of her own sons to represent it. At that time at least the place sought the man. As we have said, the antecedents of the idea that a study of insects would benefit the farmer, before it became incorporated in Dr. Harris, are of themselves an interesting subject of bibliographical research. With these we have not here to do, but with the laying hold of the notion by Massachusetts and turning it to practical account. From Dr. Harris's writings we can see that he took something from Kirby and Spence, and it does not seem strange that such an observer should have arisen in the North American colonies founded by the English. It is New England, with her sober and sombre inclinations, which practically gave birth to this active, unornamental side of the study of entomology. And to this earnest spirit, this disposition to take a serious view of life, to enquire what is right and best to do in this world, New England owes her position and influence. We shall here keep this in mind and try to show its importance in our social development. When I think of the part of the world's work performed by the Puritans, then also the echo of Dr. Harris's style rises to my lips—*there is another kind of moth found in Massachusetts.*

But no account of the progress of entomology in America should be given without reference to Louis Agassiz. It is not that, in the single treatise on this subject which I have seen, Agassiz by the force of his genius, lifts the study of entomology into the region of the serious sciences, but it is in his character as a great teacher of nature's secrets that he influences the rise of entomology, its renaissance in America, as well. Agassiz preaches not only to Boston, but is sent to the Gentiles also. Everywhere, as the fruit of his lectures, societies spring up and the sentiment for nature is reawakened in scholastic shape. Philadelphia may remain true to its version of science, with its French eighteenth century perfume, to the sober excursions of Leidy, Lea and Wilson, but everywhere throughout the country the halls are filled by the followers of Agassiz. The fault of Agassiz's school, its formalism, its reliance on a label, its rage for classification, as the end and not the means, its devotion to the machinery of science, all this is less apparent in Agassiz himself than in some of his followers. I remember that the prospectus of an Agassiz society in California once fell into my hands. This society was evidently the result of a spurious enthusiasm attending the lecturer. The seed sown by Agassiz had sprung up too quickly and the heat of the day I suspect finished that society. But the prospectus itself was a sufficient comment upon the school which gave it birth. It was nothing more than a cut and dried catalogue of natural objects, commencing with man, *homo sapiens*, with Order, Family, Genus and Species,—only names and nothing more.

It represented a man
fied, tucked away;
to lighten the cata-
to carry the torch
quarrelsomeness, it
doctors are busy na-
cured. This is what
conduct, unselfishne
lightened Christian
class, but it is oft
himself disapproves
is undoubted that t
Agassiz exercised
certain natural qua
it is in his writings.
scure and silent; b
of his thought, fron
inferred from his
Superior," now a r

Dr. Harris hin
plicity with which l
ing. He has the n
us clear thoughts of
grateful to Dr. Har
not in his good nat
confidence which th
sions upon the worl
of other people's r
discovery. When l
position of the Hes
says, (p. 430): "If
will serve to shew,
is the economy of t
that he has not (in
ledge. He makes r
The consideration w
with Hübner's illust
that industrious Ge
Morris says in Flint
Harris "knew" Hü
as the result of a f
unambitious of him
his duty. His repo
the doings of insec
With all this there i
be easily spared in
preoccupied with his
him are, however, n
tent caterpillar: "I
against these caterpi

* *Papilio*, 3, 61, who
named can never antedat
figure only, should not b
where accepted." Dr. E
death left a few plates o
Hübner, not to Geyer. 1
parison of the title page

It represented a museum, with everything stuffed or in alcohol, everything labelled, classified, tucked away as disposed of, designated properly once for all, without a live thought to lighten the catacomb. This fire Darwin was to bring and Agassiz's own scholars are to carry the torches, Marsh, Packard, Morse and the rest. The fault of science is its quarrelsomeness, its egotism, its belief, not in humanity, but in itself. Everywhere the doctors are busy naming diseases, but what humanity demands is that its evils should be cured. This is what unfavorably contrasts Science with Religion, with that practice of good conduct, unselfishness, gentleness, that enthusiasm for what is right in itself which an enlightened Christianity displays. More than Religion, Science needs men of the first class, but it is often served by men of the second, mere disputants. Much as Agassiz himself disapproves of the quarrels of scientists, of which I have the proof in a letter, it is undoubted that the rise of Science in America brought this fault to the surface. That Agassiz exercised an influence over Harris cannot be doubted. But Harris had a certain natural quality of his own which resisted an outside pressure and reveals itself as it is in his writings. Beside the widely heard lecturer, Harris becomes comparatively obscure and silent; but the smaller man is nevertheless heard by posterity from the potency of his thought, from the single-mindedness of his purpose. That Agassiz esteemed Harris is to be inferred from his having confided to him the entomological chapter of his "Lake Superior," now a rare book.

Dr. Harris himself is an author who may be read to-day on the subject. The simplicity with which he imparts his information lends a charm to his quiet style of writing. He has the merit of perspicacity. The sentences with their dependent parts, give us clear thoughts clearly expressed, and not only for what he gives us should we be grateful to Dr. Harris, but for that which he refrains from giving; that which it is clearly not in his good nature to give. He never misrepresents anyone, nor does he abuse the confidence which the State of Massachusetts has reposed in him by circulating aspersions upon the work of others at the expense of the public. He is extremely careful of other people's reputation, neither ridiculing ignorance nor concealing independent discovery. When Miss Morris came forward with her statement as to the method of oviposition of the Hessian fly in opposition to Dr. Harris's own observation, he merely says, (p. 430): "If, therefore, the observations of Miss Morris are equally correct, they will serve to shew, still more than the foregoing history, how variable and extraordinary is the economy of this insect," etc. Dr. Harris feels, with the candor of a large mind, that he has not (in common with the rest of mankind) sounded the depths of knowledge. He makes room for the unknown, for that at least which he does not know. The consideration which Dr. Harris habitually shows is a proof that he was unacquainted with Hübner's illustrated works when he renamed several species so beautifully figured by that industrious German entomologist. I agree therefore on this head with what Dr. Morris says in Flint's edition of the report, and I regard Dr. Hagen's supposition* that Harris "knew" Hübner's names and rejected them, as doing injustice to Dr. Harris, and as the result of a false estimate of Dr. Harris's character. Dr. Harris is throughout unambitious of himself, intent only on bringing out entomological facts in pursuance of his duty. His report, therefore, nowhere reads like autobiography; it treats solely of the doings of insects, and what must be done by us to circumvent their ravages. With all this there is little of what may be called literary effort, and literary effort may be easily spared in a report, provided the English is good. Dr. Harris is too staid and preoccupied with his work to indulge in humour; such sallies of wit as we may find in him are, however, neither flippant nor tawdry. He incites to a general war against the tent caterpillar: "I beg leave to urge the people of this Commonwealth to declare war against these caterpillars, a war of extermination to be waged annually during the month

* Papilio, 3, 61, where Dr. Hagen says: "It is a rule everywhere accepted that a figure even (*sic*) named can never antedate a description." What Dr. Hagen means is probably that a name, published by figure only, should not be preferred on account of priority. I do not admit that the "rule is everywhere accepted." Dr. Hagen was evidently not studied the literature of European Lepidoptera. Hübner's death left a few plates of the "Samlung" undistributed, but the species are wholly to be attributed to Hübner, not to Geyer. It is different with the "Zutraege," which were completed by Geyer. A comparison of the title pages and preface to the "Zutraege" will sustain this view.

of May and the beginning of June." There is no uncertain ring about this. It is the opinion of the writer that "Carthage must be destroyed." And, after invoking the aid of "every able-bodied citizen" and every "housewife," he ventures to say "that the enemy will be conquered in less time than it will take to exterminate the Indians in Florida." From his language we can see that Dr. Harris stood nearer to the Revolution. The Seminoles we may infer were regarded then as a sort of pest, and the extermination of Indians was always a part of the regular Puritan programme. At any rate, Dr. Harris, here at the outset, recognizes the value of co-operation. Unless the farmers take hold generally and apply the wisdom contained in the State Reports, they will have been issued in vain.

As a technical writer on the butterflies and moths Dr. Harris shows a rare excellence. His account of the butterflies of New England is remarkably full and accurate, considering what had been previously published on the subject. I have always read with keen interest the pages upon which he has given us the histories of the Spinner moths. The natural impatience with which inexperienced entomologists, in their rage for exact nomenclature, are apt to feel at his occasional mistakes, leads them to neglect this portion of the report, which, nevertheless, it would do them good to read and ponder over. These lovely Spinner moths, escaping by the hands of time from the cage of winter, make a hidden glory in the world. On purple wings they cleave the night, in their brushing flight becoming early worn and old through the quick impatience of their lives. We pin them in our boxes and write very learned paragraphs about them, forcing these soft creatures, with their curved and rounded outlines, into our square and rigid categories. But they escape us still, and, after all our efforts, we dissect mere dead chitine at last. Yet it affords a livelihood for some of us butterfly farmers, and, for others, the chance of being sometime remembered by name, of becoming in a way oneself a species lifted out of the individual ranks—the most trifling immortality, to be named in connection with a moth! As I have discovered some facts in the history of the White Mountain butterfly, it may carry some faint memory of me upon its wings. We may remember Dr. Harris by a host of insects which fill our fields each summer. Yet there is something more to be attained than to be thus remembered by posterity. We may feed our souls by study and observation by the way side, gathering with our experience a host of happy memories. Thoreau says: "I can recall to mind the stillest summer hours, in which the grasshopper sings over the mulleins, and there is a valour in that time the bare memory of which is armour that can laugh at any blow of fortune." We must bring something away with us beside our specimens. A healthier mind, a nobler resolve, the virtue that comes from watching the struggle for life, impressing us constantly like the wind that blows upon us and is never quiet. The Hindoos say that, for purity, there is nothing to be compared with wisdom. I do not doubt it. But through action and application we reap the reward of our wisdom and test its value. But what a small field in the stretching prairies of wisdom we entomologists cultivate, whose fences yet contain for us a universe! When the true succession of evolution has been made out, we must still make shift to live and die, still face the same conditions of life and await the same end. The problem of life changes its aspect, but remains unsolvable.

My copy of Dr. Harris's writings is one originally presented by the author to Dr. Fitch. It contains a few marginalia by both, and I give here those of Dr. Fitch upon Harris's account of the Spinner moths. These present some few points of interest, for, while our knowledge is fuller, it is far from perfect, and a certain interest pertains to the remarks of one who followed so closely in the footsteps of Harris. On page 241 of the report, after Harris's account of *Gnophria vittata*, Dr. Fitch writes: "Vide *Lithosia depressa*, Fabr., Sup. p. 460." I have not consulted this reference. I have given, I believe correctly, the synonyms and the name for the variety of this species in my check list. Previously the names were not properly referred. After *Arctia Americana*, Dr. Fitch says: "A specimen was sent to me from Canajoharie, but I have never met with it in Washington county;" and then adds "'till July 27th, 1864." To *Arctia acraea*, Dr. Fitch notes: "I took a specimen at Fort Miller, 1832—where it could hardly have been introduced in the way Harris supposes." This is in reference to the remarks on

page 249 of the report. Dr. Fitch says: "I have taken it from the coast of Florida, where it infests the bitter-sweet (*Orgyia leucostigma*), but it has not been identified. It appears to be not that species which, from the account of Dr. Harris, not unfrequently is mentioned as one of the insects of Georgia." Dr. Harris thinks also of Fabricius. Dr. Fitch says: "The species consist of repetitive nests; in fine weather they are stowed." To *Gnophria vittata*, Dr. Fitch adds, "On the 'Pine Moth,' in the description I have fancied, in the same way that they are found in North America. I regard the protection of the family as a duty, and this is a species of *Arctia* are represented in Australasia and Brazil. The Spinner moths is an ancient and typical Spinner moth from whence also geographical distribution of Spinner moths, are not crossing the Atlantic. The fauna of the United States is a typical light may be

Dr. Harris's account is either technical or biological science finally separated, in the reports of Descriptions of moths, all these, with reports. What discussion of the best method involved in the reports. For technical of the well-known names to secure a then, some doubt are simply distributed to the publication seems to be the most legitimized by the something of which how unequal the general intimate structure

page 249 of the report, as to the species being carried in the chrysalis form with the salt hay from the coast. On the larva of *Hyphantria texor*, Dr. Fitch adds: "It here infests the bitter walnut most, and the swamp oak nearly as much." Of the females of *Orgyia leucostigma*, Dr. Fitch says, "They have a dusky dorsal vitta." Dr. Fitch makes no remark upon Harris's *Dasychira leucophæa*, which is probably incorrectly identified. It appears also that the moth determined in the Harris collection as *achatina* is not that species but *Clintoni*. Nor are there any marginalia to *Lagoa opercularis*, which, from the description, is not Abbot's species but perhaps *L. crispata*. In fact Harris, not unfrequently but mistakenly, identifies allied Southern forms, figured in the insects of Georgia with New England species, as first pointed out by Dr. Packard. Dr. Harris thinks also that *L. opercularis* (i.e. *crispata*?) may be the *Bombyx Americana* of Fabricius. Dr. Fitch further notes to *Clisiocampa Americana* (larva), that, "Their lives consist of repetitions of three acts, eating, sleeping and enlarging or adding to their nests; in fine weather they often repose outside of the nest, lying side by side, closely stowed." To *Gastropacha Americana*, Dr. Fitch adds: "I found this on the white oak in the middle of July in Stillwater, Md." To the account of *Dryocampa imperialis*, Dr. Fitch adds, "On the pines around Philadelphia abundant (T. B. Ashton) locally called the 'Pine Moth.'" With a criticism of Harris's expression "especially behind the tip" in the description of *Perophora Melsheimeri*, p. 301, the marginalia come to an end. I have fancied, myself, that the Spinner moths belong to the east and north, in the same way that the Hawk moths belong to the south, the Owlet moths to the West of North America. In fact several species seem to be alpine or sub-alpine, and when we regard the protective cocoon and the frequent woolliness of the moths, one would consider the family fitted for resisting the cold. But it is in reality very generally distributed, and this is a proof of its long existence as a group. The Ghost moths, or *Hepialinæ* are represented over the globe with but little structural variation, retaining in Australasia the general peculiar form which they display in Europe, California, Massachusetts and Brazil. I believe, therefore, that this particular sub-family of the Spinner moths is ancient and has survived many physical changes of the earth's surface. The typical Spinner moths, such as the *Attacine*, seem wanting in the West India Islands, from whence also I have seen no *Ceratocampinæ*. This is a noteworthy observation in geographical distribution. I have also noted that the *Ceratocampinæ*, or Hawk Emperor moths, are found over the level country, east of the Rocky Mountains and Andes, not crossing the mountains to the Pacific as it would seem. By a strict comparison of the faunæ of the West India Islands and the continent of North America, some additional light may be thrown on the physical history of these portions of America.

Dr. Harris is an author whom we can conscientiously recommend to students of either technical or economic Entomology, for in the report the two departments of entomological science are not separated; it was hardly time for that; but they must be finally separated, and I have always deprecated the mixing up of technical entomology, in the reports of State entomologists, with economic entomology, their proper subject. Descriptions of new species, opinions as to matters of special classification and nomenclature, all these, with which the technical entomologist deals, are out of place in State reports. What the State intends to pay for is a history of injurious insects and a discussion of the best means to prevent them. There is then a certain abuse of their position involved in the introduction by official entomologists of extraneous matter in their reports. For technical work we have the proceedings of the various societies, the pages of the well-known *Canadian Entomologist*. It was, indeed, the opinion of Agassiz, that names to secure adoption should be published in works offered for sale. There exists, then, some doubt whether technical entomologists should pay attention to reports which are simply distributed and thus not generally accessible. The question here comes up as to the publication of authoritative names in technical entomology. The sole criterion seems to be the recognisability of the object intended. Names for genera are sufficiently legitimized by the statement of the type. The type, an already described species, is something of which science has already cognizance, something known. When we reflect how unequal the generic formulas are, how opinions differ, how rarely, at least formerly, the intimate structural features are given, the justice of this simple rule becomes appar-

ent. Undoubtedly the worker who gives accurate and detailed accounts of his genera is entitled to more praise. As to species, and I have worked much with specific diagnoses in different languages during the past thirty years, there is no standard except recognisability for their validity. And this is imparted by a figure very well, generally indeed much better than by a description. Hence a figure, without description, should secure acceptance for the specific name attached. Although the arts of painting and writing have separated, a fundamental idea unites them and the author and the painter may still be compared. For primitive man expressed his idea by picturing the object before letters were invented. Some writers are like scene-painters, laying the colour on thickly and drawing their outlines boldly. They allow for the distance from which their work will be viewed. The distance of the spectator from the object to be viewed is replaced in letters by the ignorance of the reader of the subject discussed. He is impressed by the treatment because he does not know the subject in its detail, being carried away by the distinctness of the main idea, adopting the writer's view easily because forcibly and singly impressed upon his mind. Other writers indulge in detail work all finely laid on; they are like painters in miniature whose work is executed and may be studied under a glass, of whose general subject, as a whole, one may lose something in following the parts. This comparison is often in my mind between painters and authors so that the shelves of my library seem like a gallery of paintings, mental pictures hang about the titles on the back of the books, pictures affecting me more or less pleasantly. In my thoughts I make the good qualities of many entomological writers my own and thoroughly enjoy them. The splendid industry of Mr. W. H. Edwards, the scholarship of Mr. Scudder, Dr. Packard's talent, the thoroughness of Prof. Fernald, the clearness and gentleness of Prof. Saunders—all come home to me. And Dr. Harris impresses me by his largeness and earnestness. A homely landscape with shade and sun, flower and bee. This largeness and fine simplicity may be influenced to some extent by his surroundings, by the great and venerated University near his work. But the natural man is evidently superior to his surroundings, rises above them at times, although the nearness to such a centre of education gives both elevation and harmony to the soul disposed to receive the impression. All these entomologists are men of the first class, with faults of the second, not men of the second class with faults of the first. About all our work there is a sense of incompleteness, but to ensure our enjoyment the incompleteness must come as an after taste, not at once offend our palate. In most departments of thought there is some one author who, by his calmness and reasonableness, gives us confidence and prevents us from being carried off our balance by the assertions and claims of the rest. Dr. Harris seems to perform this useful office in the literature of entomology; so that, from his writings, one obtains a needed refreshment. He is so genuine, so full of his subject and yet so modest and unobtrusive. The plant of entomology is growing ever, spreading into our lives and affording occupation for many busy workers. But it may be long ere we meet one like Dr. Harris. The personality of man has a feeble beginning, is so little differentiated, but at length it out-tops the universe. A chip of the world which seems greater than the whole. So, in the world of entomology, Dr. Harris will always seem to have been a great man. All writers appear to stand at different angles to the truth, which, as Turgenev says, we cannot grasp as with hands. The position which Dr. Harris occupies as to the truth which is in the science of entomology, is most direct. In the meantime we are year by year adding to the picture of the science, filling out the pattern after Nature, describing species after species. When shall we get to the end of our catalogues?—*there is another kind of moth found in Massachusetts.*

SOME T

Much dissatis the structure of tl stages of insects a the various worker with Nature as pos for one system over as much as possibl his system accordi

Now, as there tending, it seems t Nature's method i engaged in the inv the fact that Natu therefore, any syst ficial.

Now, a form i another has so ma decide just where t give them places to into genus and spe Nature has not. some extent; if it look at a check list with apparently no parts with ease; t uninitiated the su them at all. We but we have to s to be made, and t those engaged in t of life, as well as

A knowledge describing and nar knowledge include more is required o and it is unfortunat qualified for it; th accomplished scier

Do the divisi lines, to be of val its dividing lines a exact, and it was so varieties were a species and varieti the kinds of variet

Our knowled derived from the e the marvellous ext time, and we may does. The terms

SOME THOUGHTS ON THE DETERMINATION OF SPECIES.

BY J. ALSTON MOFFAT.

Much dissatisfaction is expressed with the determining of species in entomology on the structure of the imago alone, and great advantages are anticipated when the earlier stages of insects are all worked out. A laudable desire is expressed in the writings of the various workers in systematic entomology to bring their methods as much into harmony with Nature as possible; this is hopeful. A naturalist should allow no personal preference for one system over another to influence him in his work; his attitude should be to discover as much as possible of Nature's mode of operation, work on parallel lines, and construct his system accordingly.

Now, as there is considerable divergence in the direction to which these labours are tending, it seems to indicate that there is a decided difference of opinion about what Nature's method is, or a misunderstanding of its interpretation. No one can have been engaged in the investigation of any department of biology without being impressed with the fact that Nature is not constructed on any principles of mathematical exactness; therefore, any system aiming at that must be, just in proportion as that is attained, artificial.

Now, a form is often met with in life that seems to fit in nowhere comfortably, whilst another has so many points in common with widely separated forms that it is difficult to decide just where to place it; hence, I suppose, the temptation to multiply divisions, and give them places to themselves. One great objection to our present method of dividing into genus and species is, that it often has the effect of separating forms in a way that Nature has not. When a form is termed a "species" it stands apart from its fellows to some extent; if it is placed in a different genus it stands yet further apart. When we look at a check list, with its divisions and subdivisions made with exactness, and names with apparently no natural affinity, one would expect to be able to separate the various parts with ease; then look at a representative collection; what a contrast! To the uninitiated the surprise is, where the necessity was for separating the great bulk of them at all. We may in a joke tell him that in the name is easily seen the difference, but we have to acknowledge that in the insect it is microscopic. But divisions have to be made, and that they may be made just where Nature indicates, it is desirable that those engaged in the work should know the life history of the insect, its habits and mode of life, as well as its appearance in its various stages.

A knowledge of structure only—size, form and color—is sufficient for the purpose of describing and naming an insect, the object of which is future identification. If that knowledge includes the earlier stages, so much the better for the purpose, but a good deal more is required of him who would endeavour to give it its natural position in a system, and it is unfortunate that much of this latter work has been done by those only partially qualified for it; the "mere collector" often having more knowledge of Nature than the accomplished scientist.

Do the divisions of genera and species meet the requirements of nature? Dividing lines, to be of value, should be stable; they look rigid; life in Nature is never rigid, and its dividing lines are of the most undulating and irregular character. Scientific terms are exact, and it was found that genera and species did not meet the requirements of science, so varieties were added to supplement them, and now the principal trouble centres around species and varieties, no definition of the term "species" being satisfactory to all, and the kinds of varieties being many, and the origin of some of them unknown.

Our knowledge of the laws of propagation in the animal economy is principally derived from the experiments with animals in domestication, and the results attained show the marvellous extent to which variation can be carried when continued for a length of time, and we may safely conclude that what man cannot do in this direction Nature never does. The terms used in this work are species for all forms that, when brought together

produce fertile progeny; varieties for all the various forms from such a union; hybrids for such as are invariably infertile from a given union, such uniform infertility being taken as a proof that the parents belonged to different species. This arrangement is brief, natural, easy to comprehend, and exact, and is as applicable to animal life in Nature as in domestication. The way man obtains his varieties is by careful, intelligent selection and isolation; no such control being known to exist in Nature for such a purpose, the appearance of varieties there must be referred to some other cause. Many species vary greatly, a few seem not to vary at all. There are many kinds of variations—1st, sexual, where the sexes differ in size, form and color; 2nd, seasonal, different broods of one species appearing at different times of the year, differing in some respect; 3rd, local, where different forms of the same species are found in different localities; 4th, well-marked varieties of some species, found in the same locality, coming from the same parents, belonging to the same brood; 5th, species that give broods in which no two specimens are exactly alike.

Into the causes of all this I do not enquire; it is in the constitutions of the organisms; how it got there we may never know; it is a fact of their existence, that is enough for the present. One thing we may be certain of, it is not of recent origin, it may have been accumulating for times indefinite. About the first there is no trouble when once the fact is known. The second has been satisfactorily dealt with in the last check list of North American butterflies. The fourth wants to be dealt with in the same manner; the mode of speaking of "a species and its varieties" is not in harmony with Nature. A species is one, its parts may be many, and each of them is of equal value in the make-up of the species; the varieties of a species seem to express the natural relationship. In the fifth there can be no separation made. Now for the third: migration is well known to be a habit of many insects; that the external influence of "climate and environment affects the descendants from a common parent form" is also a well-known fact in every department of biology. Some insects are extremely sensitive to these influences, a slight change in location producing a perceptible difference in their appearance. Others are found in widely separated parts of the globe with no perceptible difference in them. All kinds are not affected in the same way or by the same influences. We know that in and in-breeding of domestic animals has the effect of producing a fixity of type that is afterwards difficult to overcome. So here, a lengthened residence in one locality will give the influences of that locality an opportunity to impress themselves on the resident and its descendants, which will tend to give the change produced a more permanent character. Now, if we breed two such migrants through all their stages and find them differ from one another in each, are we warranted in concluding that they are two species?

Dr. McMonagle, in his evidence before the Ontario Agricultural Commission, says that he has examined the egg-cells of horses under the microscope, and found that the cells of the thorough-bred were all of the same type, form and vitality, whilst those of the cross-bred were not so, and that he could distinguish the one from the other. Now, if such a change is produced in the higher forms of life, how much more likely in the lower? It is by crossing the two forms that we are to discover whether they are species or the varieties of a species. How often do we meet in entomological literature with such expressions as, good species, true species, separate species, distinct species; as if there were species that were not good, true, separate, and distinct; scientific terms ought not to be so handled. Let me refer to the *Colias* controversy for illustration. We have various forms extending from the Atlantic to the Pacific; a large number of these have been investigated, carefully described, and distinguishing names given to them, and unfortunately termed species, and placed in the catalogues as such. Some one discovered sufficient proof to satisfy him that they are not species, and wished to abolish eight or ten names and bundle as many separate forms under one name and call that a species. This seemed to make it necessary, to save the descriptions and distinguishing names, for some one else to try and prove that they were species; and so it went on. Now, as the object of describing and naming is for future identification only, and not to settle the question of its standing, which can be done at any time when sufficient information has been obtained, without disturbing anyone's description and name, let all the forms that have been discovered to be of direct kinship, from east to west, north to south, be placed under *Philodice* (I use

this name merely to see, except by abolishing this would have some localities, which were in his own legal limits the genius—the material more in many which exists in of the "high board reading the description present "genera" "nearer to Nature's c

From what we species are not to be can be gathered into will not decide, this

How genera are see, except by abolishing This would have some localities, which were in his own legal limits the genius—the material more in many which exists in of the "high board reading the description present "genera" "nearer to Nature's c

The migratory and modify their appearance in systematic arrangement ever since insects with their constitutions in to manifest themselves upon. Then man n We know something work during all his to-day of the original continent, that, or the geographical modification.

MISCELLANEOUS

In *Insect Life* the loss to the cotton worm, (*Aletia*) during the season of next the percentage there would have been bales of cotton actual in some counties the if there had been a makes an aggregate spot was a little over Texas from this insect. But Texas is only one

this name merely because it is old and well known), and the distinguishing name after ; this would give us at a glance the correct relationship of the various parts ; and if their residence in latitude and longitude can be fixed and indicated, so much the better. This is the manner in which my third division wants to be dealt with. What a charming "constellation" they would make in our catalogues and cabinets ; so distinct and so natural, and expressive of the extent of our knowledge of their kinship and distribution ; laying a solid foundation for future investigation, and offering strong inducements to make yet further conquests in the same direction.

From what we now know of the earlier stages of many butterflies, it can be seen that species are not to be clearly defined by these any more than by the mature insect. They can be gathered into resembling groups, in the one just as they can in the other, but that will not decide, this way or that, their specific value.

How genera are to be brought into harmony with nature I really do not at present see, except by abolishing them altogether and dealing with large, loose, family groups. This would have something of the effect of removing high board fences from around small lots, which were intended to prevent trespassing, and compel each one to remain within his own legal limits, and, indeed, not even to see beyond it. Such grouping would give the genius—the man of insight and extensive knowledge—a better opportunity to arrange his material more in accordance with their natural affinities, restore that unity and harmony which exists in Nature, making it apparent to the casual observer by the removal of the "high board fences" of our present artificial divisions. I have often thought when reading the descriptions of the early stages of many forms that if we were to call our present "genera" "species," and our present "species" "varieties," we should be much nearer to Nature's divisions than we are now.

The migratory habits of insects, and the external influences of environment to change and modify their appearance, should never be forgotten in any effort to decide their place in systematic arrangement. This is not a thing of recent occurrence, it has been going on ever since insects were first introduced into this scene of life, so that they may have in their constitutions inconceivable possibilities that are only awaiting a favourable opportunity to manifest themselves ; which must ever make structure an uncertain foundation to rest upon. Then man must have been the means of greatly complicating Nature's operations. We know something of what he has done in recent times, and he has been doing similar work during all his history, but observing it not ; so that we can have but little knowledge to-day of the original form and habitat of any species, whether they belong to this continent, that, or the other, or whether similar forms of all the continents may not be but geographical modifications of one species, investigation having little, if at all, taken that turn.

MISCELLANEOUS NOTES :—GATHERED FROM VARIOUS QUARTERS.

STATISTICS OF LOSS FROM INSECTS.

In *Insect Life* for August, 1889, there is given a carefully prepared table showing the loss to the cotton crop in the State of Texas, in consequence of the ravages of the cotton worm, (*Aletia argillacea*). The quantity of bales of cotton actually produced during the season of 1887 is given for each county in the State in one column ; in the next the percentage of loss from these insects ; and in a third column the product that there would have been without this loss. The total result shows that there were 1,125,499 bales of cotton actually gathered in the State ; the average loss was 21 per cent., though in some counties there was none reported ; and the crop that should have been gathered, if there had been a total exemption from insect damage, was 1,422,948 bales. This makes an aggregate loss for the State of 297,449 bales ; the value of each bale on the spot was a little over \$40 on the average. The actual money loss to the planters of Texas from this insect in a single year was, therefore, the enormous sum of \$11,897,960. But Texas is only one of many cotton-growing States, and its production is about one-

fifth of the whole product of the south. Throughout all that region—the cotton belt as it is termed—the worms were pretty equally active in their operations. We may safely estimate then, that the total loss to the cotton growers of the Southern States in 1887, occasioned by these insects, was not far from the appalling sum of sixty millions of dollars. It is a wonder that so shrewd a people do not see that it would pay them well to expend a hundred thousand dollars a year upon practical entomology, if it resulted in the saving of even one-tenth of this enormous sum.

CATERPILLARS STOPPING TRAINS.

We have occasionally observed in the newspapers brief notices of such occurrences, but have rarely been able to learn what particular insect was referred to. A correspondent of *Insect Life*, (Mr. S. Webster, of Mattawankeag, Maine), has sent the editors the subjoined account of a stoppage on the new line of the Canadian Pacific Railway, in Northern Maine, occasioned by caterpillars; the report is taken from the *Upper River News* of that State. Mr. Webster has also stated that in the Northern Penobscot region, the same worm defoliated most of the orchards, and all of the poplars, leaving them as bare as in mid-winter. From specimens sent it was ascertained that the insect was the Forest Tent caterpillar, (*Clisiocampa sylvatica*): we give an illustration of this familiar pest, fig. 47. Mr. Webster found that it seemed to prefer poplar, and also fed upon oak



FIG. 47.

and cherry, and after these were stripped it attacked the elm, gray birch, willow, rock maple and some other trees.

“The grand march of the caterpillars.—They blockade a train on the Canadian Pacific.—Freight locomotives and railroad men powerless.—Mosquitoes join in the raid and do bloody work.—Additional motive power and sand effect their release.

“The first freight train run in connection with the Bangor and Piscataquis over the Canadian Pacific, met with a novel and what at one time threatened to be a serious as well as a laughable mishap on Sunday. Our managing editor was in it. At a point a few miles from Sebois, on the Canadian road, the Messrs. Pierce Brothers, of Milo, had collected 1,500 ship knees, and Superintendent Van Zile sent down a big engine and eleven flats to draw them up to Brownville crossing.

“They were loaded, and the return trip of fifteen miles was begun, which occupied ten hours. When the train had proceeded a few miles, and when it was on a short grade, it was brought to a standstill by an army of small, gray caterpillars, greasing the track and driving-wheels to such an extent as to almost entirely suspend friction between the rails and the driving-wheels. In some places they were half an inch thick, and the army stretched out eleven miles.

"The night previous, as the time-keeper, who had about twenty miles to cover, was working homeward on his jigger or railroad velocipede, he encountered the advance guard, and for half a mile pushed his machine along the rail by hand.

"Section men undertook to sweep them off with alder bushes, but the slight touch of the twigs would crush them and lubricate the rails, and the mass formed like dough upon the driving-wheels.

"The train in going down passed through these and others, but the big collection came during the forenoon, and while the knees were being loaded. Of course, sand was used, but it did not avail much, and Superintendent Van Zile was wired, and he ordered out another locomotive from Sebois.

"On her arrival there began a series of charges at that grade, which now had been liberally sprinkled with sand, but the animal life was so thick that various attempts were unsuccessful, and it was not until late at night and the sun had gone down that the creeping things desisted in their march.

"With these there had come clouds of mosquitoes, and they very materially aided the other insects by pitching most vigorously into the men, seemingly drawing blood from all nationalities alike, and the sight of a sweating, swearing railroad laborer, frantically brandishing alder boughs over his head with one hand, while with the other he scraped caterpillars, was laughable in the extreme.

"The matter has at once engaged the attention of Superintendent Van Zile, who is trying to find out from the encyclopedia how long the march of these Maine hosts continues, and it is quite likely that the road alongside this section will be ditched and flooded with running water. Nothing like it was ever known hereabouts before, but then sunlight was never before let into the wilds of Maine as the Canadian road has let it in, and there may be unknown difficulties to come consequent upon it."

THE EFFECT OF ARSENICAL INSECTICIDES UPON THE HONEY BEE.

The prevailing opinion seems to favor the theory, that if arsenical mixtures are sprayed or dusted upon fruit trees while the latter are in bloom, the bees which frequent them will be destroyed. With this idea in view fruit-growers have very properly been cautioned not to use these mixtures during the blooming season, and in fact this has been urged as an argument against the use of these substances as insecticides.

The writer, while in Louisiana, was told by planters that dusting Paris green upon the cotton plants, killed the bees which frequented the blossoms thereon for the purpose of securing the nectar which was contained in them.

There appears, however, to be some good negative evidence bearing upon the problem, which it will be well to consider before forming a decided opinion in this really important matter.

Mr. Edwin Yenowine, a fruit-grower near New Albany, Ind., is a very strong advocate of the use of arsenical mixtures, as against both Codling Moth and Plum Curculio, and is also, to a limited extent, engaged in apiculture.

Some time ago, while spending a day with Mr. Yenowine, he reminded me that several years ago he had written me as to the probable effects on bees of the use, during the blooming season, of these arsenical mixtures, and had received a very cautionary reply. It appears that instead of following my advice he sprayed all sorts of fruits freely during a period of two years, both in and out of the blooming season, and instead of destroying his bees they have increased from eight to seventeen strong, healthy colonies, and have furnished honey of which he and his family have partaken freely. This conversation with Mr. Yenowine took place on the 23rd of June, so that the increase shown was practically that of one unfavorable season, that of 1888.—F. M. Webster, La Fayette, Ind.

REMEDY FOR THE PLUM CURCULIO.

In the bulletin of the Ohio Agricultural Experiment Station for September, 1889, Mr. Clarence M. Weed gives the following results of his experiments carried on through two seasons, upon two varieties of cherry trees and four of plum trees, and during which the large number of 65,500 cherries were individually examined, and any insect injuries carefully recorded. He finds that "About three-fourths of the cherries liable to injury by the Plum Curculio, can be saved by two or three applications of London purple in a water spray, in the proportion of one ounce to ten gallons of water; (2) That a sufficiently large proportion of the plum crop can be saved by the same treatment, to insure a good yield when a fair amount of fruit is set; (3) That if an interval of a month or more occurs between the last application and the ripening of the fruit, no danger to health need be apprehended from its use; (4) That spraying with the arsenites is cheaper and more practical than any other known method of preventing the injuries of this insect."

REMEDIES FOR THE STRIPED CUCUMBER BEETLE.

The same careful observer, Mr. C. M. Weed, gives an account of his experiments with remedies for the Striped Cucumber-beetle (*Diabrotica vittata*)—the very common yellow beetle with black stripes along its wing cases (Fig. 48), which attacks cucumbers, melons, squashes, and other plants of the same family. A great many remedies and preventives have been recommended for this insect. In order to test the efficacy of these, Mr. Weed has carried out a series of experiments, and furnishes the following summary of results:



FIG. 48.

The methods recommended were divided into four classes, viz: 1. The use of offensive odours in order to keep away the beetles. 2. Coating the plants with substances that would produce a mechanical barrier to their feeding. 3. Poisonous coatings of the leaves in order to kill the insects. 4. Preventing their attacks by enclosing the plants under some form of tent or gauze-covered frame.

The experiments were made on a large scale under ordinary field conditions during the summer of 1889, when the striped beetles were exceedingly abundant.

Five substances of the first class were tested, viz.: hen manure, cow manure, kerosine, carbolic acid and bi-sulphide of carbon. None of them proved practically successful.

Three substances of the second class were tested, viz.: Coal-soot, gypsum and saltpetre. Of these the soot and saltpetre proved worthless, while gypsum showed some beneficial effect, but not enough wholly to save the plants.

Three substances of the third class were applied, viz.:—pyrethrum, "slug-shot," and "peroxide of silicates." Pyrethrum (Persian insect powder) killed the beetles with which it came in contact when first applied, but soon lost its efficacy. "Slug-shot" injured the plants to which it was applied. "Peroxide of silicates" had a decided effect in preventing injury, and where the plants had been well started before being attacked saved them from destruction; but it did not save them when the beetles were so numerous that they burrowed down to meet the sprouting plants before they were out of the ground.

The results obtained from the fourth method—that of fencing out the insects by covering the plants with some form of tent or gauze-covered frame—were by far the most satisfactory. The cheapest and most successful method employed is that of protecting each hill by a piece of plant-cloth or cheese-cloth about two feet square. This may be done simply by placing it over the plants and fastening the edges down by small stones or loose earth. It is better, however, to hold it up by means of a half barrel hoop or a wire bent in the form of a croquet arch.

Mr. C. P. Gillette, in the bulletin of the Iowa Agricultural Experiment Station for May 1889, gives an account of his experiments on this insect, with much the same results

as those obtained by Mr. Weed. He found, however, that *dry* pyrethrum dusted over the plants in the early morning (5 a. m.) was a complete success. "At this time in the morning the beetles are cold and sluggish, and their bodies damp with the dew of the night, so that they do not fly away, and every particle of the powder that falls on them sticks. Forty hills of squash vines were treated in this manner with two ounces of the powder, and at two o'clock in the afternoon 280 dead beetles were counted about a single hill of five small plants."

BIRD MURDER IN FRANCE AND ITS EFFECT UPON SOME NOXIOUS INSECTS.

Any one who takes a walk abroad in the rural parts of France, when farming operations are going on, will often see small children following the plough armed with small pitchers, into which they put all the white fat grubs of the cockchafer which are turned up. In England the rooks do this work, without young children being withdrawn from school or from play. But the French sportsman has nearly extirpated these useful birds. A recent iniquity is the systematic destruction of the swallows on their return from Africa. Emissaries of the Paris *Modistes* fix up on the shore, about the points where the birds usually land, long wires connected with powerful electric machines. The wearied swallows perch on the wires and are struck dead by scores. Their bodies are then sent off to Paris to ornament women who are a disgrace to humanity. The saddest feature is that our English contingent of martins and swallows arrives by way of France, and will doubtless be cruelly decimated.—J. W. SLATER, in *Science Gossip*.

We do not know which to wonder at the most, the industry of the women or the numbers in which the White Grub (larva of the European *Meolontha vulgaris*) must have occurred in the soil, in the statement made by M. Reiset and quoted in "*La Nature*" for the 18th of May, where it is stated that in a field of about one hectare (2½ acres) a single woman collected 759 pounds (344 kilograms) of these White Grubs or Cockchafer larvæ in 15 days. The actual number of grubs was estimated at 180,000.—*Insect Life*.

BLACKBIRDS VS. CORN BOLL-WORMS.

My field of corn was in full roasting ear, and the blackbirds were swarming in it. My hired man came to my library and told me we must get some boys with guns to shoot blackbirds, or they would ruin our corn. He added, "The neighbors are all in their corn-fields shooting to drive away the blackbirds." I told him to wait until I had time to see what the blackbirds were doing. On entering the field there were enough blackbirds in sight to have ruined the field of corn in a short time. I spent an hour or more in the field of 24 acres, and did not find an ear that showed the birds were eating the corn. The birds would light on the ears, and spend but a short time there, and pass to another ear. I noted ear after ear that I had seen a bird on, and I always waited until the bird had finished his work on it. I found on every such ear the marks of the boll-worm. They were developed enough to have commenced eating the grain. There were the evidences that the worm had been there, and I saw the blackbirds there, and making passes as if picking out the worms, and after the bird had left the ear I could find no worm. The birds seemed to be busy hunting and eating this destructive and disgusting pest. I left the field pleased and grateful to the blackbirds. I told my hired man he need not waste any time or powder on the birds. They were welcome to hunt worms, and could take what corn they wanted to make a variety. Now, this is not sufficient to show that blackbirds are in the habit of feeding on boll-worms, I know, but it satisfied me that the birds were destroying thousands of them for me. The season was dry, the meadows were short, and the grass dried on the hillsides overlooking my bottom fields. The conditions were these: corn in full roasting-ear, the earth dry, and the weather hot. The corn at husking time was not injured by birds more than usual, which is so light as to be almost inappreciable. I hope I may have opportunity this season to make further observations, and that the good work of the blackbirds may be established by many witnesses.—L. N. Bonham, Columbus, Ohio, in *Insect Life*.

SPARROW DESTRUCTION IN AUSTRALIA.

Miss Eleanor A. Ormerod, consulting entomologist to the Royal Agricultural Society of England, has forwarded a donation of £5 to be applied to the destruction of sparrows in South Australia. A subcommittee of the Royal Agricultural Society of South Australia has undertaken to raise subscriptions in aid of this worthy object, and it is proposed to have monthly competitions in the production of sparrows' heads and sparrows' eggs. These competitions will take place after the next autumn show in Adelaide. At the autumn show there will be a grand prize competition, when prizes of £2, £1 10s., 10s. and 5s. will be offered for the largest number of sparrows' heads, and the same value in prize-money will also be offered for the largest number of sparrows' eggs. Additional to this, every competitor who fails to secure a prize, and yet brings in 100 or more heads or eggs, will receive a bonus of 2s. 6d., and any one producing under 100 and not less than 50 heads or eggs will receive a bonus of 1s. These prizes and bonuses ought to encourage the boys to exert themselves.

An American paper tells us that: "There is a scarcity of our native song birds; the sparrow drives them away and destroys their eggs and young. Dr. Merriam estimates that a pair of sparrows in ten years will increase to 275,716,983,698. They migrate over the country in grain cars, in which they have been caged while stealing breakfast. They can be destroyed by throwing down a handful of wheat and shooting among them with fine shot. The owl and hawk are very helpful and should invariably be spared."

In Victoria the fruit-growers are becoming alarmed at the depredations of the sparrows, which are exceedingly numerous. A Bill was lately placed before the legislature there, to provide means for relieving cultivators from this pest, but, as in South Australia, it was opposed by those who were not subject to losses, who were too indolent to examine into the truth of the complaints made, or who were too selfish to interfere in a matter in which they were not directly and personally concerned. A few of the opponents were led away by statements that the Sparrow does little harm in its native home in England, but it is a fact that it does a great deal of damage, though it is there kept from increasing so rapidly as in Australia—first, by the colder weather, which limits the breeding season to a month or two, whereas in Australia the season lasts nearly all the year through; and secondly, in England there are many owls, hawks and other enemies which prey upon the Sparrows, whilst in Australia these enemies are almost entirely absent. Perhaps, when it is too late, the opponents to the Sparrow bill will find that their pockets and personal comforts are very intimately affected by the presence of hordes of these little pests, which drive away all the insectivorous birds, but will not touch an insect (except from pugnaciousness), but which will eat all the seeds of all the plants that grow in the fields, spoil all the fruit that is produced in the orchard and vineyards, and even attack the vegetables and flowers in the gardens when there is nothing else to destroy.—*Garden and Field* [Adelaide, South Australia], January, 1889.

HOW TO GET RID OF ANTS.

Professor Fernald, in an interesting paper on Household Pests in the Bulletin for July, 1889, of the Massachusetts Hatch Experiment Station, gives the following remedy for ants when they are troublesome in the house from their attacks upon sugar and other sweets: "It has been recommended to sprinkle sugar into a sponge and place it in their path, and as it fills up with ants several times a day immerse it in hot water to kill those adhering to it. This will undoubtedly prove successful if carefully followed up for some time; but when we remember that the females are constantly laying eggs to produce workers which will take the places of those already destroyed the task seems almost hopeless.

"There can be no doubt that a better method would be to follow the ants carefully and discover, if possible, where their nest is and then destroy the entire community by

making one or more holes down through the nest and then pouring in a teaspoonful of bisulphide of carbon, carefully stamping down the ground afterwards to close the holes. The fumes of this substance will penetrate the nest in all directions and destroy the entire community."

Dr. Riley, in the October, 1889, number of *Insect Life*, gives an interesting account of a successful effort to get rid of the large black or brownish ant which is often so great a nuisance in dwelling houses. "A case was brought to my notice, he says, two years ago in Washington, where a fine old homestead was on the point of being sold on account of the annoyance caused by these ants. An investigation showed one enormous nest several feet in diameter in the back yard, and several colonies here and there in other parts of the premises. The large colony was completely destroyed by the use of bisulphide of carbon. A teaspoonful was poured down each of a number of openings, and a damp blanket was thrown over them for a few minutes. Then, the blanket being removed, the bisulphide was exploded at the mouth of each hole by means of a light at the end of a pole. The slight explosions drove the poisonous fumes down through the underground tunnels, killing off the ants in enormous numbers. The main source of the trouble being thus destroyed, the nuisance was greatly lessened, and all talk of selling the old place has ceased."

A FLOCK OF BUTTERFLIES.

BY S. W. DENTON, WELLESLEY, MASS.

While in the interior of New Guinea, in August, 1883, I observed what might properly be called a "flock of butterflies." They were apparently of one species, (of a dark-brown color, with a blue reflection on the fore-wings in a certain light,) and in such great numbers as to actually blacken the green bushes on which they lit. I first came across them one day, while out after birds, in a thick and shaded part of the tall forest in low land adjoining the Laloki River. Being so numerous I supposed it would be an easy matter to catch all I desired without the aid of a net, but after several unsuccessful attempts, in which case they would rise in a cloud and settle again in a few moments on the bushes close at hand, I was obliged to give it up. They did not seem to be very much disturbed at my approach, but would not, however, allow me to get very near without taking flight, as soon as I remained still they would immediately settle on bushes and foliage close by, but always out of reach. The flock was perhaps two acres in extent, but the butterflies were not equally numerous over this entire area, in some places every bush, branch, twig and leaf seemed to be covered with them, while in others there were comparatively few. What their object was, or how long they remained in that locality, I am unable to say, except that on visiting the place several days afterwards they were still there in apparently undiminished numbers. I might add none were seen feeding, and so far as I observed there were no flowers in bloom anywhere in the vicinity.

CATCHING BUTTERFLIES BY MEANS OF DECOYS.

BY SHELLEY W. DENTON, WELLESLEY, MASS.

It has long been a matter of fact to me, and one which has served a good purpose and doubtless to other readers of the *Can. Ent.*, that many butterflies, especially the larger kinds, are attracted by decoys resembling themselves in size and colour.

So many incidents of this nature have crowded themselves upon my notice that I trust it will not be considered presuming on my part to enumerate a few of them, and at the same time state the benefits to the butterfly hunter which may arise from this source.

My attention was first called to this fact some fifteen years ago while collecting in the neighborhood of Boston. I caught one day an example of *Papilio Turnus*, after taking the insect from my net, and while holding it in my fingers preparatory to placing

in my collecting box, another butterfly of the same kind darted down at the one I held and fluttered above it for a moment as if to entice it away. I was so surprised that no attempt was made to capture the visitor until it had risen beyond reach. Expanding and placing on a bush close by the almost lifeless butterfly which I had held in my fingers, and partially concealing myself, I awaited the insect's return, nor was I disappointed or obliged to wait long. I could catch an occasional glimpse through the bushes of my intended victim; nearer it came till, hovering for a moment above my decoy, it was easily secured. This plan was followed during the rest of that day, and more or less since that time, with gratifying results, having caught as many as 37 *Papilio Turnus* in a day, and that, too, in a place like Eastern Mass., where they are, so far as my experience goes, not very common.

While in Nevada, in the summer of 1887, this method was followed with good success in the capture of *Papilio Rutulus*, *Eurymedon* and *Daurus*; *Argynnis Leto*, *Nevadensis* and *Coronis*, *Limenitis Lorquini* and others. I found a piece of bright yellow paper, cut out to resemble *P. Rutulus*, proved almost as attractive as a butterfly of that species, and even a yellow leaf which I picked up and placed in a conspicuous spot answered the purpose very well once to enable me to secure a decoy.

I find the best place to expose a decoy is in some sunny nook where an occasional specimen of the species of which you are in search is seen, allowing the full rays of the sun (provided your decoy is a butterfly) to strike on the expanded wings. It is usually my custom to cut down the green bushes, except, perhaps, one in the centre of the opening, and stripping the leaves from the tallest sprig or branch, place my decoy on the point. The decoy may be a badly damaged specimen, one not fit to preserve.

This method applies best to the larger and stronger flying species of butterflies, and these are the ones the hunter has the greatest difficulty in procuring, especially if the country is rough and broken so that he is restricted in his movements by deep gullies, cliffs or large loose rocks. Occasionally the hunter will have an enemy in the shape of a large dragon fly, which will pounce on the coming prize just as as you are about to "scoop" it in; then away the two will go, the butterfly soaring and flapping often till almost out of sight in the vain endeavor to rid itself of the enemy which has taken such a death-like grip upon it, but this shark of the air is, in the end, generally victorious.

In some countries, such as Australia and New Guinea, and I speak of these because of personal knowledge, there are large and showy butterflies of very powerful flight which are almost impossible to catch on the wing, not only being shy but high flyers, and I know of no way in which they can be taken so readily as by the method above described. I refer particularly just now to that large and magnificent blue butterfly (*Papilio Joësa*) which in Northern Queensland may be seen alighting on or floating above the tops of the forest trees, occasionally flashing in the sunlight like a star of unusual brilliancy. It is a magnificent sight to a butterfly hunter, and one that will fill him with enthusiasm, but one likely to be of great disappointment should he wait for it to come within reach or settle near the ground where it could be taken with his net, for nine times out of ten, when it takes flight, it will sail around and away over the tops of the trees till lost from view, unless you have something to catch its eye and cause it to descend from its elevated position. Now procure one of the same species and place it in a conspicuous place in the sunlight, conceal yourself near by, but be ready to strike at a moment's notice, and await the result. Your decoy will most likely soon be seen (for it is wonderful how quickly a butterfly will discern one of its own kind) and down will come the longed-for prize to your delight and satisfaction, but you must sweep with your net at just the right time or the opportunity is lost. But perhaps you will ask how is the first specimen or decoy to be obtained? This is often a matter of considerable difficulty, I was accustomed, when rambling in the forest of that country, to carry a gun, and although when obtained by shooting they were generally in a rather dilapidated condition yet they served the purpose of a decoy very well.

One thing which has always surprised me is the remarkable sight, and perhaps sense of smell, which some insects seem to possess. Often while having a decoy exposed I

hav
the
the
suit
imp
the
die

in n
conc
of ir
quer
of ir
rega
to co
the
coco
sent
silk-
a lo
the
lowe
The
coco
lete
form
by
less
cond

four
from
marg
with
into
marg

large
color
nid la
ment,
edible
larvae

* R
Journal

have been startled by the sudden appearance of a butterfly when none were apparently in the neighborhood.

The causes which lead to the attractiveness of decoys, no doubt, are various, possibly the passing butterfly, on seeing the decoy, supposes the latter has found an abundance of suitable food. But my opinion is, that in the majority of cases it is a matter of sexual importance, and but for this powerful influence which causes them to seek each other and thereby propagate their species, these most beautiful objects of nature would eventually die out.

NOTES ON BOMBYCIDÆ.

BY FREDERICK CLARKSON.

The habits of insects present an attractive and fruitful field of discovery, illustrating in many remarkable ways their peculiar instincts, governed by heredity and more or less conditioned by environment. The power, which we call instinct, controlling the habits of insects has a regularity of action governed by ordinary conditions, but there are frequent manifestations of adaptations to circumstances as conspicuous in the several orders of insects as in the various races of mankind. The extraordinary condition can only be regarded as an obstruction to the usual law that governs instinct and compels the creature to conform to the changed surroundings. The larvæ of *Bombyx Mori*, if crowded for space, at the time of pupation, will associate to the number of three or four in spinning the one cocoon which covers them. The larvæ of *Samia Cynthia*, under like surroundings, present a similar variation of habit by spinning interior sections, one above the other, in the silk-lined leaf constituting the one envelope, so that outwardly it has the appearance of a long single cocoon. The marked feature of this dual cocoon is that while ordinarily the place of escape for the imago is at the upper end of the cocoon, the inhabitant of the lower section emerges at the lower end of the cocoon, from the lower end of its section. The *Cynthia* worms occasionally from like necessity will to the number of two spin a cocoon in common and undergo transformation in the one interior section. I have collected the past season very diminutive cocoons of *P. Cecropia*, and *S. Cynthia*, the former measuring $1\frac{1}{2}$ inches long by $\frac{1}{2}$ inch in diameter; the interior section $\frac{3}{4}$ inch long by $\frac{3}{8}$ inch in diameter; the latter was spun on a leaf $1\frac{1}{2}$ inches long, the cocoon rather less by $\frac{3}{8}$ inch in diameter. The cocoons contained the larva dead and in a dried condition.

From a cocoon of *P. Cecropia* I have obtained a very small male, measuring scarcely four inches in expanse of wing. The kidney-shaped spots on secondaries are reversed from their usual position, the pointed end being directed towards the abdominal or inner margin instead of, as commonly, to the exterior margin. The wavy white line bordered with black, on the exterior margin of the primaries, which is usually more or less pointed into the adjoining lilac, is in this specimen a line corresponding in form with that of the margin of the wing.

DROVES OF LYCÆNID CATERPILLARS HERDED BY ANTS.

BY MRS. WYLLY, OF INDIA.*

The larvæ of *Tarucus theophrastus*, Fabricus, are cultivated and protected by the large common black ants of Indian gardens and houses. The caterpillar, which varies in color from a light pure green to a dark reddish tint [this is a common variation in *Lycænid* larvæ], is about three-quarters of an inch long, louse-like in shape, and slow in movement, and it feeds on the *Zizyphus jujuba*, a small thorny bush of the jungles, with an edible astringent yellowish fruit, the "Byr-coolie" of the natives. Some *Lycænidæ* larvæ have the power of protruding and retracting at will two small fleshy tentacles or

* Reprinted from an article entitled "Butterflies and Ants," by Lionel de Niceville, F.E.S., in the *Journal of the Bombay Natural History Society*, Vol III. p. 164 (1888).

horns, each tufted with a brush of fine hairs, from the upper surface of the tail segments. Between [on the next segment, anteriorly] these tentacles is a small slit, from which they exude a small drop of a juice of some sort eagerly sought by the ants, and which they can generally procure by stroking the larvæ gently with their antennæ. The ants set up what appears to be merely a temporary nest at the foot of the tree, the better to carry on their operations. Just before the rains set in, about the middle of June, great activity among the inhabitants of a *Zizyphus* tree may be observed. The ants are busy all day long running along the branches and leaves in search of the larvæ, and without fail an ant will come on one full-grown and meditating on the choice of a snug retreat [in which to turn to a pupa]. A friend or two turning up, the ants set to work to guide and drive their caterpillar in the direction they wish him to go, *i.e.*, down the stem of the tree towards their nest. This is not always an easy business if the prisoner is refractory and would prefer going somewhere else. But as a rule they are docile and easily led. Having kept guard over him until they get him safely into his proper berth in the row, and he has accepted their ultimatum as final, he drops off into a preliminary doze, and undergoes his transformation into a pupa. If you gently scrape away the loose earth piled up at the base of the tree, you will see some hundreds of larvæ and pupæ in all stages of development arranged in a broad even band all around the trunk, and lightly covered with earth. The ants object to their being uncovered, and will immediately set to work to re-cover them, and, if you persist, they will remove all the chrysalids, and bury them lower down. When the butterfly is ready to emerge, which is in about six or seven days, it is tenderly assisted to disengage itself from its shell, and should it be strong and healthy, it is left undisturbed to spread and strengthen its wings and fly away. But if by any mischance it emerges deformed and too crippled to use its wings, a catastrophe occurs. In one case a butterfly had fallen to the ground before its opening wings had dried, and one of the soldier-ants tried to rescue it. He carried it back to the tree with the utmost care, and made several attempts to assist the butterfly to hold on again. Finding his efforts unavailing, he left the cripple for a short time to recover itself. On his return, seeing no improvement, he appeared to lose patience, and, rushing in, bit off both the deformed wings at the base, and carried off the wingless body into the nest below, whether as food for the community, or for what other purpose, I was unable to ascertain. That was the only occasion on which I ever saw any high-handedness on the part of the ants, though their usual ill-temper requires no very close observation to detect. It is a curious sight to watch the fragile and delicate new-born butterflies wandering about, all feeble and helpless, amongst the busy crowd of coarse black ants, and rubbing shoulders in perfect safety with the ordinary fierce, big-headed soldiers; as odd a contrast as the fresh, creamy whiteness of the opening wing, the flash of purple and blue, and the sparkle of green and silver eyes is to the darkness and dinginess of their queer home. For some time after the butterflies have gained strength to fly away they remain hovering over the nest. A larva of a species of *Catopsilia* [one of the *Pierinæ* or "Whites"] I threw down as an experiment was immediately set upon and torn to pieces in a second by the ants.

I took a *T. theophrastus* larva from a tree, and introduced it on the pathway of another company of the same species of ants who lived in our verandah, but kept no "farm," and it was odd to see the ants come tumbling out headlong to fight the intruder, and the sudden way they cooled down on investigation of the foe. None attempted to harm him, and he was politely escorted across their boundary, the ants running alongside and feeling him all over with their antennæ. This must have been instinct, as they could have had no former knowledge of him as a "milk-giver." The dead chrysalids in an ants' nest are carefully removed and thrown away outside; the ants also distinguish between the dead and the living.

wh
hea
a v
of
dur
des
rec
pro
ma
of
seq
for
and
sho
sho
as
in
arti
of

a s
"I

and
be
Fig
bee
attu
to l
we
Kü
wei
Pro
the
the
Pro

inse
anc
M.
the
mill
rich
mi

THE MEDITERRANEAN FLOUR-MOTH.

(Ephestia kuhniella. Zeller.)

BY JAMES FLETCHER, OTTAWA.

Probably the most interesting occurrence, from an entomological standpoint, which has taken place during the past year, was the discovery that a mill in the heart of one of our large milling centres had been infested to such an extent by a vast colony of insects as to necessitate the closing of the mill and the cessation of all business. This insect proved to be a new pest to America, but one which, during the last decade, has received much attention in Europe, where it is described as "the scourge of the Mediterranean ports." Immediately upon its recognition the attention of the government was officially drawn to it, and prompt and radical measures were adopted to ensure its extermination. The matter was placed by the Hon. Minister of Agriculture for Ontario in the hands of Dr. P. H. Bryce, the secretary of the Provincial Board of Health, who subsequently published the results of his enquiries and investigations in pamphlet form as Bulletin I. of the Board of Health. This publication is plainly expressed and treats the subject in a practical manner. The importance of the matter is shown and the history of the attack is told. The insect in its various stages is shown by figures, and as much of its life-history in Europe and in this country as was known is detailed. At the time of the first appearance of this new pest in Canada, there was very little available literature upon the subject, the only article of a practical nature being that by Miss Eleanor A. Ormerod, Entomologist of the Royal Agricultural Society of England, in her Twelfth Report.

Since the publication of Dr. Bryce's pamphlet a very complete article giving a summary of the known history of the insect has appeared in the pages of "Insect Life," vol. ii., p. 166.

This article gives much valuable information and describes the larva of another closely allied species, *Ephestia interpunctella*, (= *zeæ*, Fitch) which might be confounded with the Mediterranean Flour-moth. The beautiful illustrations, Fig. 49 and 50, used herewith, were drawn specially for that article, and have been kindly lent to our society by Prof. Riley. Although this insect has attracted much attention during the last ten or twelve years it does not appear to have been known until the year 1877, when specimens of the moths and larvæ were placed in the hands of Prof. P. C. Zeller, of Grunhof, Germany, by Dr. Kühn, Director of the Agricultural Institute of the University of Halle. They were stated to have been very troublesome in the bolting cloths of a flour mill. Prof. Zeller found that they belonged to a previously undescribed species, and in the *Stettiner Entomologische Zeitung* for 1879, pp. 466-71, he described it under the name *kuhniella*, after the gentleman who sent him the first specimens. In Prof. Riley's article above mentioned the following records of injuries are given.

Predhomme de Borre, in 1884, gave an account of injury done by this insect in Belgium. In May of the same year Dr. F. Karsch records the appearance of the moth at several places along the Lower Rhine. In the same month M. Maurice Gerard read a note before the Entomological Society of France on the ravages of this moth, which had appeared in enormous numbers in a flour mill at Lodelinsarte, Belgium. In an editorial note in the *Entomologische Nachrichten*, for 1885, mention is made of reports of the appearance of the insect in mills near Bremworde, and in the same publication a review is given of a com-

munication by Prof. P. H. Landois, in which it is stated that this pest is by far the most annoying and dangerous of all the insects affecting wheat or flour. In 1887 five articles appeared in English magazines, giving accounts of the appearance and habits of the insect as observed in English mills and warehouses. The first of these was by Mr. W. Thompson, of Stoney Stratford, who reported the first appearance of the pest in England. The most important English article, however, is by Miss Ormerod, who summarises the known facts concerning injuries by this insect, and gives details of a new attack which had been brought to her notice in the north of England during 1888. The state of affairs in the infested mill, as described by Miss Ormerod, was practically the same as was found to be the case in our Canadian mill. Her correspondent writes: "I have got quite a plague of moths in the mill, some of which, and worms, I send you; they get into the spouts and machinery and do no end of mischief, both by destroying the silks and stopping the flow of flour, etc., in the spouts by spinning their webs and hanging there. The mill is in constant work, and I should have thought this would have prevented them from lodging, but it does not seem to affect them at all."

The following statement by the manager of the mill which was so seriously affected in Canada is taken from Dr. Bryce's pamphlet, and is virtually a resumé of the different points as they were brought to my notice during the investigation.

"The first appearance of the *Ephestia kuhniella*, or flour moth, that we remember seeing was during the month of March last, 1889. The moth was seen flying about near a steam pipe in the basement of the mill. Little attention was paid to it, as from appearance it did not indicate any danger. In April there was an appearance of a few moths on the different floors of the mill, even at the top, but still there was nothing suspicious. In the month of May we were troubled with a few worms in some of our goods, and in June more of them appeared. In July they increased rapidly, and then we began to suspect they were from the fly which we had seen in the mill during the previous months and which was steadily increasing in numbers. About the middle of July we shut down for a day or so; took the clothing from our bolting reels and cleaned it and washed the inside thoroughly with soft lye soap and lime. We did the same with the elevators. When we started up again every corner and part of the mill had been thoroughly cleaned, as we supposed, and we commenced to work again, but after about four days we found our bolting reels, elevators, etc., worse than before. They were literally swarming with webs, moths and worms, even inside the dark chambers of the reels. We shut down again and made a more thorough cleaning by washing, etc. While this was going on we found there was no use to try and clear ourselves of the pest as the mill walls, ceilings, cracks, crevices and every machine was completely infested with moths, cocoons and caterpillars, and there was no use going on. It then occurred to us that a plague like one of the plagues of Egypt was upon us. The moth was different to any of which we had had any knowledge or experience, and we decided to apply to the Dominion Government for relief and assistance. We addressed the government entomologist, Mr. Fletcher, and sent him samples of the moth, caterpillars, webs, etc., and received a prompt answer which considerably alarmed us. This letter was followed by others almost daily from Mr. Fletcher and a visit from Prof. Saunders on the 17th of August. Mr. Fletcher visited us also on the 27th of August; but in the meantime Mr. Blue, the Assistant Minister of Agriculture for Ontario, visited us and took in the whole situation. It was explained to Mr. Blue that the Dominion Government had been appealed to by us, through Mr. Fletcher, the

Dominion Government entomologist, for assistance and remuneration for the loss we had sustained. Mr. Blue, considering it to be a matter with which the Local Government had to do, brought Dr. Bryce, Secretary of the Provincial Board of Health, and submitted the matter to the Government for action. Afterwards Dr. Bryce and Mr. Fletcher came together, and finally the whole matter was left in charge of Dr. Bryce and the Provincial Board of Health.

"In the meantime we took down our machinery and subjected it to steaming. Every part was thoroughly steamed. The mill was swept down and subjected to sulphur fumes. The walls, ceilings, etc. were cleaned, and elevator spouts and loose wooden work burnt up. Paper bags and hundreds of dollars worth of goods were burnt in the furnace, while the other bags, elevator belts and cups were boiled for hours in a cauldron of water. The machines and all parts that were not destroyed were then burnt by means of a kerosene torch, which flamed and smoked through and around every part of them until we considered we had everything clean and ready for putting together again.

"But on the 19th of September the Local Government passed an Order in Council compelling us to take more stringent steps, or rather ordering the Provincial Board of Health to take immediate steps for the suppression of the pest. This Act was approved of by His Honour, the Lieutenant-Governor, who signed the Order in Council, and on the 20th September we received an order from Dr. Bryce which stated that before placing our machinery in position we should subject it to a thorough disinfecting process in a strong room so arranged that steam under pressure might be drawn or driven into it.

"In compliance with this order we at once constructed a tight steam box six feet wide, six feet high and 12 feet long, and attached a steam pipe to it from the boiler. In this box we put every machine, and even our mill stones and iron rollers. This process was very expensive and took up considerable time, as we were over a week at the process and were delayed in the placing of our machinery. The Board of Health visited us in a body during the time this process was going on and pronounced it a success. This was all done not only in our own interests, but in the interests of the public health and commerce of the country. Having now got to the position which enables us to go to work again after two months loss of time, and the loss of machinery, fixtures, stock and expense, we have arranged for remedial measures to prevent the reappearance or destruction of the pest should we ever be again attacked. We have erected a steam stand-pipe with hose or other connection on each flat of the mill building. By shutting up all doors and windows of each flat and turning on the steam simultaneously to each floor the whole building can be filled with hot live steam sufficient to kill anything. This will rust all bright parts of the machinery, but to remedy this we intend using oil on them, should we ever be under the necessity of resorting to the measure.

Another purpose of this steam stand-pipe will be, in cold weather, to let on sufficient steam to moisten every thing and part of the building at night and let the frost penetrate so as to kill any eggs or insects that may have become lodged in unseen parts.

By these measures, with plenty of light, thorough cleanliness, a cold mill, and caution in taking in stock and old bags, we hope to keep free of a pest which has given us so much trouble and loss.

The above accounts serve to show what a serious matter was the introduction of this insect into Canada. There is no class of foods more important to the masses than those which we derive from cereal crops, any cause therefore which brought about their destruction was an enemy menacing the whole community. By the

thorough treatment which was applied, it is probable that this attack has been put an end to, and every one should feel under a deep obligation to the Hon. Charles Drury for enabling Dr. Bryce to do his work so thoroughly.

An account of the habits and life-history of this insect, which has suddenly become so celebrated, will probably be of interest and will enable our readers to recognise it in its different stages should it make its appearance at any future time.

The perfect moth is shown at Fig. 49, *c* and *f* slightly enlarged, the actual length of average specimens is shown by the hair-lines at the side of the figures.

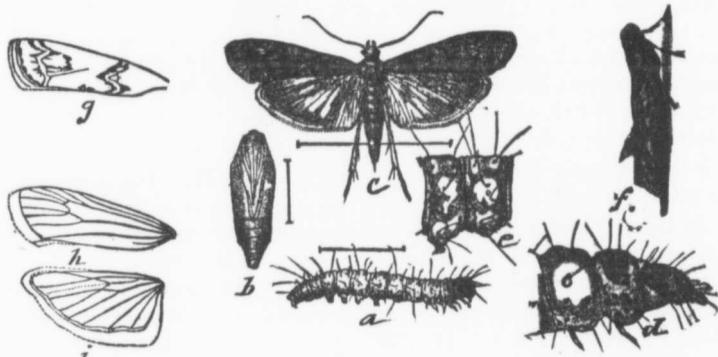


FIG. 49.

The moth when the wings are spread measures about $\frac{7}{8}$ of an inch from tip to tip of the wings. The colour is leaden-gray more or less sprinkled with black scales and the forewings are crossed by transverse angled waved lines as shown in the figure. When the specimens are fresh the colours are much brighter than they are a few days after they have been killed. The ground-colour of some specimens which were left for ten days in a cyanide killing bottle changed to a yellowish brown tinge. I mention this point from the fact that in the article in *Insect Life* it is stated that in the typical specimens raised by Zeller, the ground colour is pure yellow or nearly brownish. I have no doubt of the identification of our Canadian insects as the true *E. kuhniella*, Zeller, for specimens were sent to Prof. C. H. Fernald for confirmation, and I have lately received from Mr. O. E. Janson specimens from Germany, which had been found feeding on flour, and of which he writes: "I have compared these and find they agree precisely with the type specimens in the Zeller collection now in the British Museum, and also with some specimens which I have reared from larvæ found in warehoused flour in the east end of London, you may therefore have no doubt as to the identity of these examples. Some specimens have the forewings of a darker shade with the blackish marking a little more pronounced than in those sent, others are rather paler with the markings less distinct, otherwise I have seen very little variation in the many specimens which have come under my notice."

The moths are rather sluggish in the day time but are active at night. When at rest they are difficult to detect the wings are drawn in close to the body after the manner of the *Crambidae* or grass-moths, which belong to the same natural order, and the antennæ are folded back and crossed over the thorax, sometimes the attitude shown at *f* is assumed, but not so commonly as in the case of the Meal Moth (*Asopia farinalis*, L.) When fresh from the chrysalis, the females will remain for hours in this position, with the abdomen protruding between the wings, but more erect than in the figure, in fact at right angles with the line of

the body and with the ovipositor extended to its fullest length. Pairing generally takes place and eggs are laid within 24 hours. An anatomical examination (by Prof. H. Landois) showed the number of eggs in a single female to be 678. Of four separate females which I have enclosed immediately after pairing, the number of eggs laid has in each instance been a little under 300; but this does not necessarily disprove the above statement.

The eggs are beautiful objects; under the microscope they are about $\frac{1}{10}$ of an inch in length, about half as wide as long, of an oblong form with rounded ends and having the surface marked with rather large star-shaped prominences, the radiating lines or wrinkles of which are waved. The eggs are greenish white when first laid, $\frac{1}{10}$ of an inch in length, oblong or slightly kidney shaped with rounded ends, and are deposited singly or sometimes in strings of from three to fourteen, connected by their ends. Mr. Sidney Klein found that "the eggs appeared to be laid on the top of the sacks, and hatched within a few days. The larvæ burrowed through the sacking, spinning long galleries through the flour, generally not penetrating to a greater depth than three inches." (*Insect Life*, vol. ii, p. 170). This may be the case or the eggs may be pushed in between the meshes or into crevices of woodwork where flour has lodged; the ovipositor of the female is so long and slender that this would be quite possible. In the breeding jars the eggs were laid indiscriminately all over the surface of the glass and grain placed in the bottom; but in one jar, the neck of which was closed with a plug of cotton wool, a large mass of eggs was found, pushed into the cotton, over a quarter of an inch from the surface, where they had been laid by the females. Three lots of eggs laid in October and November and kept inside my study hatched in 19 days, this period would probably be rather shorter in summer-time.

The caterpillars are very slender active little creatures, rather under $\frac{1}{10}$ of an inch in length when first hatched, of a pinkish-brown colour with dark heads, and they are covered with long slender hairs. After leaving the egg-shell which they seldom eat, as many caterpillars do, they wander about quickly looking for food. From the very first they have the habit, which when they are larger constitutes one of their most injurious characters, of spinning silken threads wherever they go. They not only eat a certain quantity of flour but render a much larger quantity useless by the copious silken threads and tunnels which they spin through their food at all stages of their larval growth. A tin box $3\frac{1}{2}$ inches high by 2 inches in diameter, filled with Indian corn meal as food for about 30 nearly full-grown larvæ, in about a month had the contents so permeated and matted with their webs that the whole of the meal could be raised in one thick felted mass. When the caterpillars get into the complicated machinery, which is used for bolting and cleaning flour, their chief injury arises from these webs which they spin all over the surfaces, but also from their eating holes into the gauze through which the flour is sifted. When full-grown, if possible, they leave their food and crawl to some corner where they spin a close cocoon of silk into which they also weave particles of flour or dust. Some of the caterpillars which I have had in my study since September have remained as caterpillars in a semi-torpid state for four months; but most of them have changed to chrysalises and moths. From the fact, however, that some remained torpid in my room which was kept constantly at about 65 degrees of heat, I believe that under ordinary circumstances many would hibernate as caterpillars. Miss Ormerod thinks that where there is warmth as in a mill that there is no definite succession of broods; but that the pest is present constantly in all stages. In Rep. xii, p. 69, she writes: "The attack may be considered as going on constantly where temperature is suitable, for we have notes of appearance of the moths in May, June, July, November and December; and intermediate observations of larval or pupal presence point to

"this, which, when once established, is indeed a mill or flour *scourge*, as being an all-the-year-round pest." The full-grown caterpillar is a little more than half an inch in length, of a greenish white or sometimes of a decidedly pinkish tinge. The head is reddish-brown and bears a few long bristles. The thoracic and anal shields as well as the thoracic feet are honey yellow. The spiracles are yellowish and inconspicuous. Along the sides are four series of dark piliferous tubercles. (i.) Sub-dorsal, consisting of an anterior and posterior tubercle on each segment from 5 to 12. (ii.) Lateral. (iii.) Sub-stigmatal and (iv.) supra-ventral. The sub-stigmatal series is double throughout, *i.e.*, each tubercle bears two bristles, separated a little at the base. On segments 3, 4, and 13, the sub-dorsal and lateral series are represented by a single large double tubercle instead of two separate tubercles as on the other segments. These three tubercles are the most conspicuous marks on the larvæ. The lateral series consists of double tubercles on segments 2, 3, 4, and 13, and of two bristles on the remaining segments, one of these, above and slightly anterior to the spiracle, is very small. The tubercles are small but distinct, the dark colouring is in the form of a cloud round the bases of the bristles, which in the lateral series on segments 3 and 12 takes the form of a black ring round the white base of the larger bristle and the smaller bristle is placed on this ring. On the anterior section of segment 13 the two sub-dorsal rows of tubercles are joined by a dark cloud and there is a large double conspicuous tubercle in the lateral area.

The *chrysalis* is of the shape shown at figure *b*, $\frac{3}{8}$ of an inch in length of a honey yellow colour. This stage lasts about three weeks in September.

Prof. Riley has figured for comparison with *E. kühniella* the native species of the same genus *E. interpunctella* shown at Fig. 50, with its larvæ and chrysalis.

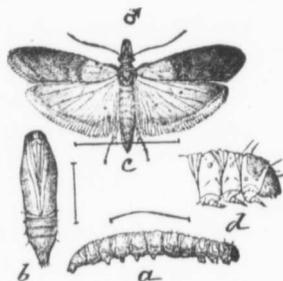


FIG. 50.

This species was found associated with *E. kühniella* in the infested mill. The moths are quite different in appearance, *interpunctella* having the bases of the wings of a yellowish drab tinge and the tips reddish mottled with purple.

"The early states are quite similar in appearance, but the larvæ may be distinguished by the following characters: the larvæ of *kühniella* are more slender and of a more uniform diameter than those of the other species. The abdominal legs are longer, cylindrical, with a circular fringe of hooklets at the crown. In *interpunctella* the legs are short, conical, with the fringe of hooklets at the crown oval. All piliferous warts in *kühniella*, most of which are rather minute, are still rather prominent, readily observed, and of a black or brown colour. Those most conspicuous are the lateral ones, in front of the first spiracle; the sub-dorsal one each side of the meso-thorax, almost completely encircled by a narrow black ring interrupted only at its upper margin, Fig. 50, *d*. In *interpunctella* all the warts, while present, are concolourous with the rest of the body, and can be dis-

tinguished only with great difficulty. The surface of the body of *kühniella* is almost perfectly smooth, while that of *interpunctella* is somewhat granulate." *Insect Life*, V. ii., p. 171.

E. interpunctella appears to be a much more general feeder than *kühniella* for while I only have actual record of the latter feeding on the following substances, preparations of maize, wheat, barley, and rice, Prof. Riley gives the following list for *interpunctella*, wheat, meal, corn, dandelion roots, chickasaw plums, sugar, dry opuntia, old books, Pecan nuts, cinnamon bark and English walnuts. Prof. Cook also mentions it as a pest in bee-hives, and I have myself bred it in numbers from European almonds, of which the larvæ had eaten both the soft shells and the kernels.

DR. CHRISTIAN ZIMMERMANN.

BY H. A. HAGEN, CAMBRIDGE, MASS.

There exists no biology nor necrology of this excellent entomologist as far as known to me, though he lived for thirty-nine years in the United States. I am much indebted to Dr. George C. Horn for Zimmermann's note book, which, with his library, came into the hands of the late Dr. J. L. Leconte.

Only a very short abstract of the contents, which are written wholly in German, can be given. The entries begin with Zimmermann's earliest boyhood and end in 1843, followed by a few pages for 1865. The narrow pages contain only the substances of events in short phrases, often very cutting both for Europe and for America. If the whole could be published it would give a very interesting picture of the life of an excellent naturalist, always kept down and hindered by want and ill-luck but always ready to "begin again." It is sad that such a life akin to the remarkable histories of former ages, published by the masterhand of G. Freytag, should have been possible in the nineteenth century—a continuous struggle of a noble soul with continuous misfortune.

Christian Zimmermann was born in Quedlinburg, Prussia, September 6th, 1800. His father and three generations before him were carpenters as the name indicates; all were born and died in Quedlinburg. Christian entered the gymnasium in 1811 and graduated in 1821. The note book May 26th, 1814, says: "I am to-day 5,000 days old." (He always counts his life both in Europe and here by the 1,000 days.) The collection of beetles begins and the study of music. His talent for music must have been obvious, as one year later he played the organ for the church service and studied thorough bass. When he graduated he writes:—"Up to this time my money was made by keeping score for target shooting, teaching children, giving music lessons, organ playing, copying music, furnishing music at funerals, stuffing birds."

His parents, who were poor, proposed that he should choose a profession, but determined to study he went to Halle, where he stayed as student from 1821 to 1825. He passed his examination after having attended the lectures in theology, philology and philosophy, but his entomological studies were never neglected.

In 1827 he published his first music, a Polonaise. When he left Halle in 1828 he was already acquainted with a large number of eminent zoologists. He went to Berlin and writes:—"Great expectations, small success, a load of cares, experience of the world." He worked with Professor Klug in the museum and gave Latin lessons to barbers' apprentices. March, 1829, working up the genus *Amara*, of which some sheets were printed. 1830. Very bad times begin; want of money. 1831. Monograph of the genus *Zabrus* finished; printed in June.

During this time he had become acquainted with many prominent entomologists and with a large number of students, who later became famous, but the constant want of means was so depressing that he decided to try his fortune as a collector in Mexico. He sold his collection of 2,400 species of beetles and his books. To enable him to fulfil his intentions twenty-four naturalists of prominence from Germany, England and Russia subscribed

six hundred dollars and a number of friends six hundred and eighty dollars to pay his debts. This was all repaid with interest by Zimmermann as soon as he had made money here, as a page in his note book states. He left Hamburg August 5th, 1832, as steerage passenger for Philadelphia. He began directly to collect and to study the English language. His collection grew rapidly, but in a few months he saw that it was impossible to work in expensive America for cheap Europe without running in debt. So he decided to leave Philadelphia and to try his luck as a teacher in South Carolina. He made the trip according to the custom of German students on foot, a knapsack on his shoulder and a few dollars in his pocket. This journey of 713 miles, in the midst of a severe winter and attended with much hardship which proves his excellent health and strength, was made in fifty days with \$27 in cash, \$6 credit, three maps, one book and a pocket knife. The visit to Dr. Melsheimer on this trip has been published before by me. The detailed report of excursion given by Zimmermann to Professor Burmeister is very interesting, but has never been printed. Zimmermann had no idea that he was here considered simply a tramp, which explains easily and rightly most of his complaints.

In Georgetown, S.C., he tuned pianos and gave music lessons till he was engaged in the South Carolina Female Institute at Berhamville to teach music and drawing. This happy change in his circumstances allowed him to pay directly the debts made in Europe with five per cent. interest. He collected largely, sometimes quoting the number collected at the end of the month or the year as "11,508 specimens have been collected," besides mentioning any remarkable forms. He made many excursions, visited Cambridge (where he saw Harris), Niagara, Albany, the Catskills, New York and its surroundings. He made the acquaintance of every naturalist of eminence. He sent to Europe many insects and received many from there, together with the newest publications. His correspondence was apparently a large one.

After a few years his situation in the school where he was engaged was given up; it had become unpleasant some time before. He possessed now an excellent collection, very comfortable furniture and three thousand dollars, and decided to buy a little farm to be used as a nursery and for raising silk-worms. In 1839 he made, as he states, fourteen "farm-reisen" in Pennsylvania, Maryland, and other states, partly with Zeigler and Morris. His project proved to be a failure, and he decided to return to Europe and to send his property to New York. After a short visit to Harris, he went to New York, to find that the vessel, with all his property, was lost in a fearful storm. His note-book says:—"Sept. 10. I am notified of the loss of my collection and property." "Sept. 16, Beginning of a new collection. The voyage is given up." "Sept. 25. Invitation of Harris to come to Cambridge," where he stayed until November 12th. On Nov. 7th new insect boxes were bought of the box-maker, Newell, in Cambridge. He made many excursions with Harris, whose family very well remember the German naturalist.

The next year he lived in Baltimore, occupied with entomological systems and excursions with Mr. Morris, and decided to return to South Carolina. Feb. 27 records a "letter to Hannah, with an offer of marriage." March 21. "Hannah answers yes." April 3. "I find *Horia sanguinipennis*." Apr. 14. "I find *Trichius maculosus*."

He had made the acquaintance of Mrs. Hannah Green, afterwards his wife, seven years ago in Georgetown, S.C. We find in his note book: "Evening with Hannah, drawings on the wall; sweet home and picture; quarrels plenty." Monday, June 21. "Arrival in Rockingham, N. Carolina." June 22. "I reach the town in the morning, visit Hannah at noon, and am married in the evening."

"Hannah begins her school, July 16, with 16 pupils, and 7 pupils of mine in music and drawing."

Sept. 17. "Dispute took place with Hannah about American culture and the fight that lately happened in Washington among the members of Congress"

It very soon became apparent that it was impossible to make a comfortable living in North Carolina, and they decided to return to Columbia, South Carolina. Here they built a school-house, forty feet by sixteen, which was inaugurated December 18th, 1843. The expense was, for the building, \$417; for Loring's globes, \$33. Income during the year, \$1,521; expenses, \$1,277.

This is the last entry in the diary, and I know nothing more of his life except what is told in some letters to Thaddeus W. Harris. Some extracts follow :—

“1865. January 1. I possess :

- “\$570.00 in Confederate money.
- “\$200.00 in “ bonds.
- “\$900 in certificates.
- “\$200.00 in provision store shares.
- “\$13.00 in bank notes.
- “\$114.90 in silver.

“Feb. 10. The Yankees are in Barnwell Co. To-day's prices : a load of oak wood, \$140; a barrel of flour, \$550.00; a pound of brown sugar, \$12.00; a bushel of corn, \$35.00.

“Feb. 17. The Yankees are here, 75,000 strong. This is the last day of Columbia. They at once entered the houses, got drunk, and set fire to everything. I began to move everything that could be moved into the garden; but they broke open the trunks and boxes with their swords, and followed this up with a regular and general plunder.

“Feb. 22. The army has left. All quiet. My collection and books brought back in the house. Expenses for these days :—1 bushel meal, \$40.00; 13 lbs. beef, \$22.00; molasses, \$6.00.

“July 1. We still possess —

\$1,100.00 Confederate States bonds, worth	\$ 0 00
\$915.00 Confederate treasury notes “	0 00
\$13.00 South Carolina bank bills “	2 00
\$3.00 South Carolina state bills “	2 00
Silver money	74 00
Gold	2 50
Copper	0 05

“We must begin again at the beginning.”

This is the closing sentence. These few simple words, without any moan over the loss of his all, are not a little touching—all the more so because the pathos is unintentional—the pathos of facts, not of words. They call to mind his former record of the loss of everything by shipwreck on the 10th September, 1839, followed by the entry on Sept. 16th, “Beginning of a new collection.”

Zimmerman died in December, 1867. He left no children.

His interest in science was always kept up. Nearly every month the number of insects collected is reported, sometimes amounting to 3,725, and during the year to 11,500. In November, 1842, he sent fifty dollars to T. W. Harris to buy three Goliaths. He constantly bought books both in Europe and America, and his library was valuable. It was bought by the Museum of Harvard College in Cambridge, excepting some volumes which were retained for his own use by Dr. J. L. Leconte, at whose instance the purchase was made.

His collection is also in the museum, having been bought first by Dr. Lewis, of Philadelphia, and from him by the late R. Crotch, who sold it to the museum. A great part is in Le Conte's collection, and can be recognised at once by the numbers on the pins, in Zimmerman's handwriting.

He was an unwearied worker. In 1842 he wrote to Harris that he was occupied with a systematic arrangement of the Lamellicorns, and wanted Echiurus and Goliath for study. In April, 1844, he writes again to Harris :—“I have almost finished my chapter on Lamellicorns.

BOOK NOTICE.

INSECTS INJURIOUS TO FRUITS; by William Saunders. Second edition. Philadelphia J. B. Lippincott Company, 1 vol., 8vo, pp. 436.

It is with very great pleasure that we announce the publication of the second edition of this valuable and important work. That a new issue should be called for is a most satisfactory proof of the excellence and permanent usefulness of the book, and establishes the fact that Prof. Saunders has provided the fruit growers of North America with a standard manual upon the insect enemies that they have to contend with.

Six years have gone by since the issue of the first edition, and during that time great and steadily increasing attention has been given to the study of economic entomology, with the result that many new methods have been discovered for successfully combatting the ravages of noxious insects. The most important and useful of these the author has now embodied in his book, and has done so with very little change in the text of the work. A superficial reader would hardly notice the alterations, but we find that many have been made, and that they bring down the information given to the knowledge of the present day. As an example, we may mention the insertion among the remedies for the codling worm, of the apple and the plum curculio, the recently discovered method of spraying with a mixture of Paris green and water, which has proved so eminently successful.

For the information of those of our readers who are not already familiar with the work, we may mention that the insects treated of are grouped under the name of the particular fruit that they attack, and are arranged in order according as they affect the root, trunk, branches, leaves and fruit. An illustrated life history is given of each, followed by an account of the most useful remedies that may be employed and of any parasitic insects that assist in keeping the pest in check. Twenty of the most important fruits are dealt with, and two hundred and sixty-six noxious insects and a large number of beneficial ones are more or less fully described. The book is beautifully printed on fine paper, and illustrated with four hundred and forty admirable wood cuts.

While this work is simply indispensable to the intelligent horticulturist, it is also of great value to the practical entomologist and a most useful book to place in the hands of beginners. The young collector will find in its pages figures and descriptions of most of the insects he meets with, and the more advanced student cannot fail to learn from it much that would otherwise escape his observation.