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SIXTEENTH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO.

1885

Printed by Order of the Legislative Assembly.



Toronto:

BY WARWICK & SONS, 26 & 28 FRONT STREET

1886.

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Agenia .....  
 Aletia xyliua .....  
 Aleochara .....  
 Alyson .....  
 Ammophila .....  
     "    luctuosa .....  
 Andrena .....  
     "    pratensis .....  
     "    nivalis .....  
 Andrenidae .....  
 Annual Address of I .....  
     "    Meeting of I .....  
         of Ontario .....  
     "    Report of I .....  
     "    Statement of .....  
 Anthaxia inornata .....  
 Anthobium convexu .....  
 Anthomyia brassicae .....  
     "    ceparum .....  
 Anthonomus musculu .....  
 Anthophora .....  
     "    terminali .....  
 Ants, wasps and bees .....  
 Apathus .....  
 Apidae .....  
 Apis mellifica .....  
 Apostemon tricolor .....  
 Arctic Regions, insect .....  
 Augochlora .....

Bacteria .....  
 Bembecinae .....  
 Bembex fasciata .....  
     "    monodonta .....  
 Bethune, Rev. C. J. S .....  
 Birds, insectivorous .....  
 Bombus .....  
     "    terrestris .....  
 Bombyx mori .....  
 Book notices .....  
 Bowles, G. J., article .....  
 Bruchus pisi .....  
 Bumble-bees .....  
 Butterfly, probable orig .....  
 Butterflies, paper on .....

## TABLE OF CONTENTS.

	PAGE.		PAGE.
<b>A</b>		<b>C</b>	
Agenia.....	49	Cabbage fly.....	5
Aletia xyliua.....	15	"    worm.....	5
Aleochara.....	11	Cacœcia cerasivorana.....	23
Alyson.....	51	Callimorpha contigua.....	38, 39
Ammophila.....	50	"    interrupto-marginata.....	38, 39
"    luctuosa.....	50	"    Lecontei.....	38, 39
Andrena.....	53	"    notes on.....	12, 38
"    pratensis.....	46	Calocampa vetusta.....	10
"    nivalis.....	47	Catocala, Aholibah.....	60
Andrenide.....	52	"    amasia.....	60
Annual Address of President.....	4, 9	"    amatrix.....	56, 57
"    Meeting of Entomological Society		"    amica.....	60
of Ontario.....	1	"    " <i>var.</i> lineella.....	60
"    Report of Librarian.....	3	"    antinympba.....	60
"    Statement of Secretary-Treasurer.	2	"    beaniana.....	56, 58
Anthaxia inornata.....	47	"    briseis.....	56, 58
Anthobium convexum.....	46	"    cara.....	56, 57
Anthomyia brassicæ.....	5	"    cerogama.....	56, 59
"    ceparum.....	12	"    clintonii.....	60
Anthonomus musculus.....	7, 9	"    coccinata.....	56, 59
Anthophora.....	53	"    colebs.....	60
"    terminalis.....	47	"    concupens.....	56, 58
Ants, wasps and bees.....	48	"    cratægi.....	60
Apathus.....	31, 54	"    desperata.....	56, 57
Apide.....	52, 54	"    " <i>var.</i> vidua.....	57
Apis mellifica.....	54	"    epione.....	56, 57
Apostemon tricolor.....	53	"    faustina.....	56, 58
Arctic Regions, insects in.....	21	"    fratercula.....	60
Augochlora.....	53	"    gracilis.....	60
<b>B</b>		"    grynea.....	60
Bacteria.....	6	"    habilis.....	59
Bembecinae.....	50	"    ilia.....	55, 56, 59
Bembex fasciata.....	50	"    " <i>var.</i> uxor.....	56
"    monodonta.....	50	"    insolabilis.....	56, 57
Bethune, Rev. C. J. S., article by.....	27	"    junctura.....	60
Birds, insectivorous.....	7	"    levettei.....	60
Bombus.....	59	"    meskei.....	56, 58
"    terrestris.....	29	"    neogama.....	59
Bombyx mori.....	6	"    " <i>var.</i> communis.....	59
Book notices.....	24, 26	"    obscura.....	60
Bowles, G. J., article by.....	55	"    pacta.....	57
Bruchus pisi.....	7	"    paleogama.....	59
Bumble-bees.....	54	"    " <i>var.</i> phalanga.....	55
Butterfly, probable origin of word.....	17	"    piatrix.....	59
Butterflies, paper on.....	31	"    polygama.....	60
		"    preclara.....	60
		"    relicta.....	56, 57

<b>C—Continued.</b>		PAGE.
Catocala residua .....	56, 57	56, 57
" relecta .....	56, 57	56, 57
" scintillans .....	60	60
" serena .....	60	60
" semirelecta .....	56, 58	56, 58
" similis .....	60	60
" " var. formula .....	60	60
" subnata .....	59	59
" ultronia .....	56, 58	56, 58
" unicolor .....	60	60
" unijuga .....	56, 58	56, 58
" viduata .....	60	60
Catocalæ .....	55	55
Caulfield, F. B., article by .....	38	38
Ceresa bubalus .....	16	16
Ceropales .....	49	49
Chionobas gigas .....	13	13
Chlamys polycocca .....	10	10
Chrysidide .....	48	48
Cimbex Americana .....	12	12
Clarkson, F., articles by .....	17, 26	17, 26
Claypole, Prof. E. W., articles by .....	19, 21	19, 21
Cleptes .....	49	49
Cænomypha canthus .....	12	12
" eurytris .....	12	12
" inornata .....	12	12
Cosmosoma omphale .....	23	23
Council, report of .....	2	2
Crabroninæ .....	51	51
Crabro singularis .....	51	51
Crysophanus thoe .....	12	12
Ctenucha Virginica .....	41	41

**D**

Danaïdæ .....	16
" " swarms of .....	27
Donations to Cabinet .....	10, 11
Dominion Entomologist .....	8
Drasteria erecthea .....	15

**E**

Elateridæ .....	11
Election of officers .....	9
Electric lamp, Entomology by .....	19
Ellaphidion villosum .....	26
Empis fly on orchids .....	43
Entomological Club of A. A. A. S. ....	23
Entomological notes .....	15
Entomology, popular papers on .....	14
Euchetes collaris .....	13
" Egle .....	13
Eudamus tityrus .....	47
Eumeninæ .....	51
Eumenes .....	51
Euphanessa mendica .....	23

**F**

	PAGE.
Fenisca Tarquinius .....	12
Formicidæ .....	48
Fossorial hymenoptera .....	49
Foul brood .....	30
Fyles, Rev. T. W., article by .....	31

**G**

Gortyna cataphracta .....	10
Gorytes .....	51
Guignard, J. A., article by .....	39

**H**

Hagen, Dr. H., articles by .....	16, 22
Halictus .....	53
Harmonia pini .....	23
Harrington, W. H., article by .....	48
Hepialus Thule .....	11
Hessian fly .....	5
Honey-bees .....	52, 54
Humble-bees .....	27, 54
Hymenoptera aculeata .....	48

**I**

Incurvaria acerifoliella .....	10
Insectivorous birds .....	7
Insects and orchids .....	39
Isosoma tritici .....	5

**J**

Jack, J. G., article by .....	15
-------------------------------	----

**L**

Lachnosterna fusca .....	49
Larra quebecensis .....	50
" terminata .....	50
Larrinæ .....	50
Leucanium tilia .....	23
Limnitis arthemis .....	16
" disippus .....	16

**M**

Macroductylus subspinosus .....	7
Megachile brevis .....	53
" centuncularis .....	47
" melanophœa .....	47
Melisodes .....	53
Mellifera .....	52
Meloe angusticollis .....	30
Methoca bicolor .....	49
Micrococcus .....	6
Monedula ventralis .....	50
Murray, Wm., death of .....	22
Mutillidæ .....	49

Nematus erichsonii .....
" ventricosus .....
New Orleans, Enton .....
Nomada .....
" Americana .....
Notodonta concinna .....
Nysson .....
Nyssoninæ .....

Oak pruner .....
Obituary .....
Odynerus .....
" capra .....
(Eneis) Bore .....
Ophion .....
Orchids .....

Antirrhinum .....
Arethusa .....
Aplectrum .....
Apocynum .....
Calopogon .....

" p .....
Calypso .....
" borea .....

Corallorhiza .....
" j .....

Cypripediæ .....
Cypripedium .....

" .....
" .....
" .....
" .....

Epipendrea .....
Epipactis .....

" gū .....
" lat .....

Goodyera .....
" me .....

" pu .....
" rep .....

Habenaria .....
" c .....

" b .....
" d .....

" f .....
" h .....

" i .....
" l .....

" m .....
" n .....

" o .....
" p .....

" r .....
" s .....

" t .....
" u .....

" v .....
" w .....

Linaria vul .....
Liparis .....

PAGE.

12  
48  
49  
30  
31

10  
51  
39

16, 22  
53  
23  
48  
11  
5  
52, 54  
27, 54  
48

10  
7  
39  
5

15

49  
50  
50  
50  
23  
16  
16

7  
53  
47  
47  
53  
52  
30  
49  
6  
50  
22  
49

N

Nematus erichsonii	12
" ventricosus	51
New Orleans, Entomological exhibit at	18
Nomada	53
" Americana	53
Notodonta concinna	16
Nysson	51
Nyssoninae	51

O

Oak pruner	26
Obituary	23
Odynerus	51
" capra	12, 51
Oeneis bore	21
Ophion	16
Orchids	39-48
Antirrhinum	43
Arethusa	41, 42
Aplectrum	41
Apocynum androsaemifolium	41
Calopogon	41, 42, 43
" pulchellus	42
Calypso	41
" borealis	41
Corallorhiza	41
" innata	41
Cypripediaceae tribe	45
Cypripedium acaule	47
" arifinum	47
" calceolus	46
" parviflorum	47
" pubescens	46, 47
" spectabile	46, 47
Epidendreae tribe	40, 41
Epipactio	41
" gigantea	42
" latifolia	41
Goodyera	41
" menziesii	41
" pubescens	41
" repens	41
Habenaria	43, 44
" ciliaris	48
" blephariglottis	45
" dilatata	44, 45
" fimbriata	45
" hookeri	45
" hyperborea	45
" lacera	45
" nivea	45
" orbiculata	44
" psychodes	45
" tridentata	45
" virescens	44
" viridis	44
Linaria vulgaris	43
Liparis	41

PAGE.

Orchids.

PAGE.

Liparis loeselii	41
Listera	41
" convallarioides	42
" cordata	42
Microstylis	41
Neottieae tribe	41, 42
Ophrydeae tribe	43
Orchis	43
" mascula	43
" rotundifolia	44
" spectabilis	44
Pogonia	41, 42, 43
" ophioglossoides	42
Spirianthes	41
" autumnalis	41, 42
Tipularia	41
" discolor	41
Vandaeae tribe	40
Ormerod, Miss E. A., present from	10
" vote of thanks to	11
Oryssas sayi	14
Osmia	53
" vicina	47

P

Pamphila cernes	47
" mystic	47
Papilio ajax	23
" asterias	45
" turnus	13
Pea-bug	7
Pelopocus	50
" cementarius	50
" ceruleus	50
Pemphredoninae	51
Phaneroptera curvicauda	45
Philanthinae	51
Phora	30
Phyciodes tharos	16
Physonota 5 punctata	11
Pieris rapae	15
Pityobius anguinus	19
Platycerura furcilla	10
Pocilionota cyanipes	19
Polistes pallipes	52
Pomphilus aethiops	49
" biguttatus	49
Pompilidae	49
Priocnemis	49
Pronuba yuccasella	16
Pyrameis atlanta	10
" cardui	15
Pyrethrum powder	5

R

Raspberry saw-fly	14
Reed, E. Baynes, articles by	1, 3
Report of Council	2

<b>R--Continued.</b>			
	PAGE.		PAGE.
Report of Delegate to Royal Society .....	4	Terebrantia .....	48
Rhopalum .....	51	Termes flavipes.....	16
Rose beetles.....	7	"    lucifugus.....	16
Royal Society, report of Delegate to.....	4	Thrycopus .....	51
<b>S</b>		Tiphia inornata.....	49
Sapygidae .....	49	Tolype vellela.....	10
Saunders, Wm., articles by.....	4, 9, 14	<b>U</b>	
Saw-fly, notes on.....	12	Underwing moths.....	55
Scoliidae .....	49	<b>V</b>	
Selandria rubi.....	14	Vanessa antiopa.....	15
Sesia diffinis.....	45	"    milberti .....	15
"    thysbe .....	45	Vespa .....	51
Social bees .....	52	"    maculata.....	52
"    wasps .....	51	Vespidæ .....	51
Solitary ants .....	49	Volucella .....	30
"    bees .....	52	<b>W</b>	
Sparrow, English.....	7, 9	Wheat Isosoma.....	5
Sphégide .....	49, 50	White ants.....	16
Sphéginae .....	50	Wintle, E. D., article by.....	27
Sphex ichneumonea.....	50	Wood bees .....	51
Sphinx drupiferarum.....	16, 45	Wood wasps.....	54
Stethobaris tubulatus.....	45	<b>X</b>	
Strawberry curculio.....	7, 9	Xiphydria albicornis.....	13
Stylops .....	30	<b>Z</b>	
<b>T</b>		Ziegler, Rev. D., Bibliographical sketch of.....	22
Temperature, effect of on insect develop- ment.....	12, 51		
Tenthredinidae, notes on.....	12		
Tenthredo delta.....	13		

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*To the Honourab*

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.....	PAGE,
.....	48
.....	16
.....	16
.....	51
.....	49
.....	10
.....	55
.....	15
.....	15
.....	51
.....	52
.....	51
.....	30
.....	5
.....	16
.....	27
.....	51
.....	54
.....	13
.....	22

## SIXTEENTH ANNUAL REPORT

OF THE

# ENTOMOLOGICAL SOCIETY

OF

## ONTARIO.

*To the Honourable the Commissioner of Agriculture :*

SIR,—In compliance with the provisions of our Act of Incorporation, I have the honour to submit herewith for your consideration the Sixteenth Annual Report of the Entomological Society of Ontario.

The Society held its annual meeting in the City of London on Tuesday, October 13, 1885, when the officers for the ensuing year were elected, and the ordinary business of the Society transacted.

I also submit herewith the minutes of the annual meeting and the audited annual financial statement of the Society.

I have also to report that the Society continues the regular publication of the *Canadian Entomologist*.

I have the honour, sir, to remain,

Your obedient servant,

EDMUND BAYNES REED,  
*Secretary-Treasurer.*

### ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO

The annual meeting of the Society was held in London, at the Society's Rooms, Victoria Hall, on Tuesday, October 13, 1885, at 8 o'clock, p.m. The President, Mr. Wm. Saunders, of London, in the chair.

*Present :* Mr. Jas. Fletcher, Ottawa ; Mr. J. Alston Moffatt, Hamilton ; Rev. C. J. S. Bethune, M.A., Port Hope ; Mr. W. H. Harrington, Ottawa ; Rev. Thos. W. Fyles, South Quebec ; Capt. Gamble Geddes, A.D.C., Toronto ; Mr. G. J. Bowles, Montreal ;

Mr. J. M. Denton, Mr. H. P. Bock, Mr. Lawrence Reed, Messrs. Weld and Macdonald, of the *Farmer's Advocate*, London, and the Secretary-Treasurer, Mr. E. Baynes Reed.

The minutes of the former meeting were confirmed.

The President gave a cordial welcome to the visiting members, and expressed the pleasure felt by the London members at meeting so many of their friends.

The report of the Council, the audited financial statement of the Secretary-Treasurer, and the report of the Librarian for the past year, were then submitted to the meeting, and on motion, duly received, discussed and adopted.

REPORT OF THE COUNCIL FOR 1885.

The Council have again the pleasure of being able to report the continued progress of the Society's work.

The publication of the *Canadian Entomologist* is maintained as ably as ever under the careful supervision of the editor, Mr. Wm. Saunders.

In connection with the collection of insects exhibited at the International Fisheries Exhibition, a very handsome diploma and certificate of award of a silver medal has been received.

At the request of the Dominion Government, and to assist in the display that will be made from the Province of Ontario, the Council have undertaken to prepare a collection of a hundred cases of insects for the Indian and Colonial Exhibition to be held in London next year, and they desire the assistance of the members in making the collection as complete as possible.

The report of the Montreal Branch is very satisfactory.

By the generous bequest of the late Mr. Wm. Murray, of Hamilton, a former member of the Society, a valuable addition of many fine specimens of Canadian insects has been made during the past year to the cabinets of the Society.

Owing to unforeseen circumstances, the Society was not represented this year as usual at the meeting of the Entomological Club of the American Association for the advancement of Science. The report of the Librarian and of the Sec.-Treasurer, will be submitted to you as usual.

Presented on behalf of the Council,

E. BAYNES REED,  
Secretary-Treasurer.

LONDON, Ont.,  
October 13, 1885.

ANNUAL STATEMENT OF THE SECRETARY-TREASURER OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, FOR THE YEAR ENDING OCTOBER 8, 1885.

Receipts.

Balance from previous year, 1884.....	\$ 99 36
Members' fees, sale of <i>Entomologist</i> , etc .....	443 91
Provincial grant, 1885 .....	1000 00
Collectors' material—pins, cork, etc .....	16 95
Interest on Savings' Bank account .....	6 72
	<u>\$1566 94</u>

Canadian Entomologist  
Library account  
Expenses of woodcut  
Annual vote  
Rent  
Caretaker  
Collectors' material  
Sundries, postage  
Balance

We certify that the above is a true and correct statement of the receipts and disbursements of the Society for the year ending October 8, 1885, and that the same amount to dollars and thirty cents.

London, Ont.

REPORT OF THE SECRETARY-TREASURER OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO

The Library is classified as follows:  
Entomology,  
Geology  
Botany  
Ornithology  
Ichthyology  
General Science  
Pamphlets

The 11 volumes of the *Canadian Entomologist* published during the past year, 38 were purchased and former purchases were exchanged for 47 Societies, 11 Canadian, 5 British, 6 European, 25 American. These are bound in increasing supply of the books are all of which are

London, Ont.

Weld and Macdonald,  
E. Baynes Reed.

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Secretary-Treasurer.

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*Disbursements.*

<i>Canadian Entomologist</i> , printing, paper, stationery, etc .....	\$555 30
Library account .....	242 33
Expenses of report for 1884, including engraving, electrotypes and woodcuts .....	169 26
Annual vote to Editor and Secretary .....	175 00
Rent .....	80 00
Caretaker.....	10 00
Collectors' material—pins, cork, etc.....	5 50
Sundries, postage, etc.....	64 20
Balance .....	265 35
	<u>\$1566 94</u>

We certify that we have examined the above account with books and vouchers, and found the same to be correct. Balance in hand and in bank, two hundred and sixty-five dollars and thirty-five cents.

W. E. SAUNDERS, }  
H. P. BOCK, } *Auditors.*

London, Ont., Oct. 9, 1885.

REPORT OF THE LIBRARIAN OF THE ENTOMOLOGICAL SOCIETY OF  
ONTARIO FOR THE YEAR ENDING OCTOBER 8, 1885.

The Library of the Society now contains 804 bound volumes, which may be briefly classified as follows:

Entomology, solely .....	218
Geology " .....	34
Botany " .....	27
Ornithology " .....	21
Icthyology " .....	6
General Science } including Entomology .....	487
Pamphlets } .....	11
	<u>804</u>

The 11 volumes of pamphlets contain 258 separate pamphlets.

During the past year \$243 has been expended on the Library in purchasing new books, binding, etc. 50 volumes were purchased and 39 volumes of donations, exchanges and former purchases were bound; of this total number of 89 volumes added during the year, 38 were purely Entomological.

Exchange periodicals and publications are received for the *Canadian Entomologist*, from 47 Societies, and periodicals comprising

11 Canadian,  
5 British,  
6 European,  
25 American.

These are bound as soon as each volume is completed, and thus form a continually increasing supply to the Library.

The books are in good order and properly protected.

All of which is respectfully submitted,

E. BAYNES REED,  
*Librarian.*

London, Ont., Oct. 8, 1885.

REPORT FROM THE ENTOMOLOGICAL SOCIETY OF ONTARIO, TO THE  
ROYAL SOCIETY OF CANADA, THROUGH W. HAGUE HARRINGTON.

As delegate from the Entomological Society of Ontario, it affords me much pleasure to announce that the Society has continued to make satisfactory progress, both in membership and in the work which it undertakes.

The monthly publication of the *Entomologist* brings before students of insects, both in this country and abroad, very valuable and interesting papers on the habits and life histories of our species, with frequent descriptions of new discoveries in our extensive country. Volume XVI. has been completed and several valuable parts of XVII. have been already issued.

The "Annual Report" No. XIV., issued by the Society, contains several instructive papers prepared especially for agriculturists, and well supplied with such illustrations as may enable them to recognize the insects therein described.

The Montreal Branch of the Society is in a flourishing condition, which is due to the exertions of the energetic and enthusiastic entomologists who reside in that city.

Gratification is felt at the evidence of a growing interest in regard to the very important question of the serious losses annually caused throughout the country by the depredation of various insects.

The Select Committee appointed by Parliament, in 1884, to obtain information as to the agricultural interests of the Dominion, issued circulars to a large number of leading fruit-growers and other agriculturists throughout the country, requesting, among other points, an expression of opinion as to the desirability of the appointment of a Government Entomologist. A large majority of the answers were in favour of such an appointment.

Two members of the Council of the Entomological Society were also called, and gave evidence before the Committee as to the ravages of insects in Canada, and as to the advantages which would result from the appointment of a competent Entomologist.

The Department of Agriculture, impressed by the importance of the subject as thus brought before its notice, has since appointed as Entomologist one of the most energetic officers and workers of our Society—Mr. James Fletcher—who has issued a preliminary report briefly describing the most noticeable injuries caused by insects last season to the various crops.

In the United States great attention is still paid to the study of Economic Entomology. Several of the States, as well as the Federal Government, make liberal provisions for the investigations of appointed Entomologists.

The published reports of such investigations are exceedingly valuable, and furnish, with the exception of that supplied by the Entomological Society of Ontario, almost the only reliable information regarding the injurious insects infesting our orchards, fields and gardens.

It is a matter of no little importance that as full information as can be obtained should be, as widely as possible, circulated among our farmers, and to this end the appointment of an Entomologist by the Department of Agriculture is an important step in the right direction.

The President then delivered his annual address.

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

GENTLEMEN,—The season of 1885 has not been distinguished by any unusual invasion by injurious insect hosts. Nothing assuming the proportion of a general or serious calamity in this direction has occurred in any department of agriculture or horticulture; nevertheless, instances have not been wanting where local injuries caused by insects have assumed considerable proportions, the sum total of which, if the results were expressed in money loss, would represent a very large sum.

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The great staple productions of our country, such as wheat, oats, barley and hay have not, so far as we have been able to learn, suffered material injury from insects in any locality in our Province. But, while the farmers of Ontario have thus been exempt, our neighbours across the lines have not enjoyed the same immunity. In the neighbouring State of New York, the loss occasioned by the Hessian fly has been estimated at over \$100,000. In the great wheat fields on the Pacific slope and also in those of Dacotah and other Western States, there have been much severer losses from the same cause. Early in August I received from a correspondent in Dallas, Oregon, samples of wheat seriously injured by another destructive insect, which as yet happily has not to our knowledge occurred in Canada. This is a small, yellowish worm from one-sixth to one-fifth of an inch in length, which is found within the stalk of wheat about or between the joints; sometimes there are four or five larvæ in a single stalk, one above each joint for the first four or five joints from the ground, which cause the stalk to prematurely ripen or wither, and thus occasions great loss. This insect, which is known as the wheat Isosoma, *Isosoma tritici* (Riley) has been observed for two or three years past injuring the wheat in Illinois, Tennessee and Missouri, and has prevailed in some localities to such an extent as to ruin the crop. From the observations thus far made it seems that there is only one brood of this insect during the season, and that it passes the winter in the straw, either in the larval or pupal state, the perfect flies appearing the following spring. Under these conditions the remedy is obvious, viz., burn both the stubble and the straw after harvest; rotation of crops has also been found beneficial.

The cabbage crop has been materially injured by the ravages of the cabbage *Anthomyia*, *Anthomyia brassicae*, a two-winged fly, which in the larval state burrows in the centre of the stem of the young plant and causes its death. This cabbage insect is a native of Europe, is very troublesome in Britain, and has been known as a very destructive insect in this country for about thirty years, but nothing is known either of the date or the method of its introduction. The flies appear in the spring and deposit their eggs upon the stems of the young cabbages about or a little below the surface of the ground. The eggs hatch in about ten days, when the young larvæ usually bore into the interior and work their way down towards the root; sometimes they merely gnaw grooves on the outer surface of the stem and by this find their way to the roots, on which they feed. When full grown they change to yellowish red chrysalids in the earth from which the flies shortly escape, the whole period of their life history, thus briefly traced, occupying about eight weeks. Usually the plants attacked soon wilt and finally die; it is believed that there are two or three broods of these insects during the year.

Several remedies have been recommended, such as dipping the roots and stems of the young plants in strong lye, or a mixture of earth and cowdung diluted with water, or a thick mixture of soot and water; any bitter or alkaline substance which would adhere well to the outer surface would probably deter the flies from depositing their eggs. Lime added to the soil in the proportion of 100 to 150 bushels to the acre, after ploughing, and well harrowed in so as to keep it near the surface, has proved a very effectual preventive measure; or even where the insects are at work upon the plants, if the earth is scraped away from about the stem of each, and a handful of lime dusted around it, and the soil again drawn up to the stem, the plants will sometimes recover. Coal dust, gas lime and stimulating artificial manures have also been recommended.

The cabbage has also suffered from injuries caused by the common cabbage worm, the green caterpillar of the cabbage butterfly, which feeds upon the foliage and often disfigures it to such an extent as to render it unmarketable. The habit of this caterpillar, feeding as it does among the folds of the leaves, makes it extremely difficult to reach with any sort of poison without at the same time rendering the cabbage unfit for use. Pyrethrum, or insect powder, which is the powdered flowers of *Pyrethrum cinerariaefolium*, has been used with good effect, either dusted on the plants or mixed with water and applied to them with a syringe, and this remedy is not in any way objectionable or poisonous. The Pyrethrum plant is in my experience quite hardy in Ontario, has stood the severe cold of the past two winters without injury, and flowered freely. It is easily raised from seed, and being a perennial species, when once established it will continue to

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During the past year or two many interesting experiments have been made and valuable results obtained, in the way of artificially introducing disease among communities of a caterpillars, sort of caterpillar plague or pestilence, which carries them off by thousands. There is a very fatal disease which appears from time to time among silk worms, the larvæ of *Bombyx mori*, when bred for the production of silk, a disease which spreads so rapidly that it frequently destroys entire broods of caterpillars within a few days. So destructive has it been, that it is estimated that the silk crop in Europe is injured to the extent of many millions of dollars annually. During the past ten years it is believed to have reduced the income of silk breeders twenty-five per cent., and in 1879, was said to be the main cause of the great falling off in the silk crop of that year, which was only about one-fourth of the amount ordinarily produced. The celebrated Pasteur investigated this disease, and found it to proceed from the presence of an exceedingly minute form of bacteria, so excessively small that it has been estimated that it would require eight millions of them to cover the head of an ordinary pin. When water containing these minute organisms is sprinkled on the leaves on which the silk worms are fed, they are found to be rapidly infected and capable of communicating this pestilential disease to others with which they are associated. The bacteria may be preserved in a torpid condition without loss of effectiveness for at least a year, probably for several years, and that without any particular care, and when required for use can be rapidly propagated in a suitable fluid.

In my address to you last year I referred to a similar form of disease which had occurred among cut-worms, so abundant in clover fields in the Ottawa district; and in 1878 and 1879 to a similar trouble among the forest tent caterpillars, at that time so abundant. Now, I am glad to be able to report a similar disease among the cabbage worms, and to indicate to you some practical results arising from investigations regarding its nature and mode of operation.

Throughout most of the State of Illinois and in some parts of Michigan, it was observed last autumn, that a large proportion of the cabbage worms sickened and died. Hundreds of their bodies were to be seen rotting on the cabbage leaves, or shrunken and dried to a blackened fragment. This was soon brought under the notice of the State Entomologist of Illinois, Prof. S. A. Forbes, a most careful and indefatigable observer, who at once proceeded to investigate the cause of this caterpillar plague. He found the disease at first to be very unevenly distributed, some isolated fields showing no trace of it, while others not far distant were fairly reeking with death and decay; but as the season advanced it spread in every direction, until in some districts almost every worm perished. He says, "we can conceive something of the significance of this disease if we imagine the terror and dread which would seize mankind if such a plague should suddenly assail human life. Whole towns would be depopulated, and the dead would rot in the streets by hundreds. There would be no escape for any, because the contagion would be conveyed by the very food and drink by which life was sustained."

On dissecting specimens of the dead caterpillars the microscope showed their intestines to be full of undigested food, and swarming with a species of *micrococcus*, which appeared in the form of excessively minute spheres about one twenty-five thousandth of an inch in diameter, sometimes single, sometimes in pairs, and occasionally in strings of from four to eight. He found that these minute organisms could be readily cultivated in beef broth, and that a single drop of fluid from a diseased worm introduced into a vessel of such broth would in two or three days render the whole contents milky with myriads upon myriads of these microscopic organisms, precisely the same as those taken from the diseased larvæ. He also found by experiment that the disease could be communicated to other species of caterpillars. Experiments continued during the present year have shown that by propagating this form of *bacteria* in the manner described, and mixing a pint of a well charged culture with a barrel of water, and syringing cabbages with this fluid, the disease may be introduced, thus furnishing us with another means of defence against some of these injurious insects.

A new strawberry insect has appeared in our midst, which is deserving of notice. In

the latter part of which appeared in Staten Island, N. there; it appears Bureau of the D. gate the subject, enquire into the for its abatement notices which ap name of the inse been known to F *Anthonomus mus* snout, only one-t dotted and spotted being found very in the collections throughout the M in any particular injurious propens A few days after in the United St berry grower in been noticed before hood, an insect w as the Sharpless stalk, selects one or hangs over b mences again. T places, which saic the Sharpless, sli this was determin and in Michigan. numbers, should Staten Island, N. reported as occur life history of thi water in the prop applied to the vin destroy many of t Further com the blossoms of repeat what has if not entirely got in a semi-torpid s The pea crop *Bruchus pisi*. N more careful in se destroy the insect from this pest, an to greater care in In the address existing between l insectivorous bird in subduing injuri controlled to a far they are subject. which has elapsed

the latter part of June last, public attention was called to this subject by some paragraphs which appeared in the newspapers. The depredations of the insect were first observed in Staten Island, New York, causing grave apprehensions among the strawberry growers there; it appeared about the same time in some parts of Michigan. The Entomological Bureau of the Department of Agriculture in Washington promptly took steps to investigate the subject, and the Chief of the Bureau, Prof. C. V. Riley, proceeded in person to enquire into the character and extent of the injury, with the view of suggesting measures for its abatement. The results of this work have not yet reached us, beyond some brief notices which appeared in the press, in which the nature of the injury was stated and the name of the insect given. This new pest was found to be a small *curculio* which has been known to Entomologists in this country for more than fifty years under the name of *Anthonomus musculus*. It is a small snout beetle which measures, including the beak or snout, only one-tenth of an inch. The body is of a dull reddish colour, punctured, and dotted and spotted with white; different specimens vary much in their general hue, some being found very dark, occasionally almost black. Heretofore it has been met with only in the collections of Entomologists who have found it to be very generally distributed throughout the Middle, Southern and Western States, and also in Canada, but no where in any particular abundance, and no one had thus far suspected it to be guilty of any injurious propensities; indeed little or nothing has been known of its habits or history. A few days after its appearance in this new role—as a strawberry pest—was announced in the United States, I received a package from Mr. J. C. Morgan, an energetic strawberry grower in Barrie, Ontario, intimating that a destructive insect which had never been noticed before was seriously injuring some of the strawberry beds in that neighbourhood, an insect which seemed to have a special liking for that variety of strawberry known as the Sharpless. When speaking of this pest Mr. Morgan says, "it climbs up the flower stalk, selects one flower and deliberately and quickly cuts it off; as soon as the flower falls or hangs over by a small thread, the insect crawls down, runs up the next stalk and commences again. This performance is varied by puncturing the open blossom in several places, which said blossom will also come to grief. It is found in immense numbers on the Sharpless, slightly on the Wilson, and on no other berry as yet." On examination this was determined to be the same species as that which had occurred on Staten Island and in Michigan. It is remarkable that this insect, never met with before in any great numbers, should have occurred in such abundance at points so distant from each other as Staten Island, N. Y., Michigan, and Barrie, Ontario, all about the same time, and not be reported as occurring at intermediate points. In the absence of further knowledge of the life history of this insect, we can only suggest as a remedy the use of Paris green and water in the proportion of a teaspoonful of the poison to two gallons of water, which, if applied to the vines with a syringe when the beetles are troublesome, would probably destroy many of them.

Further complaints reached us during the early summer months of injury done to the blossoms of the grape by the rose beetle *Macrodactylus subspinosus*. I can only repeat what has been already several times stated, that this pest may be much lessened if not entirely got rid of by jarring the vines early in the morning while the beetles are in a semi-torpid state, and collecting them on sheets and destroying them.

The pea crop has for the past year or two been unusually free from the pea-bug *Bruchus pisi*. Now that the life history of this insect is so well known, farmers are more careful in selecting the seed, while seed dealers by special treatment are enabled to destroy the insects in the peas before offering them for sale. The gratifying immunity from this pest, and the large saving thereby effected, is doubtless to be attributed mainly to greater care in these particulars.

In the address presented to you in 1880, I offered some remarks on the relations existing between birds and insects, and expressed the opinion that while the soft billed insectivorous birds are exceedingly useful, birds in general are not of such great use in subduing injurious insects as is commonly supposed, and that destructive insects are controlled to a far greater extent by their insect enemies and by the diseases to which they are subject. Experience since gained has confirmed this opinion. During the period which has elapsed much discussion has taken place regarding the English sparrow, which

has now increased to a considerable extent in many of our towns and cities, and occasional flocks of them find their way into the country. While this fearless little bird has had many advocates, the weight of evidence is undoubtedly against it, and it now stands convicted on several counts,—of destructive propensities, from the grain it destroys and devours, and the injury it does to fruit trees by eating the buds; of pugnacity, which results in its driving away other and more useful native birds, while on the other hand the good it does in the way of consuming injurious insects, as proven by the examination of the crops of many of them, is comparatively small. The question is often asked by the friends of the sparrow, when the merits of this little emigrant are under consideration "how is it that we hear no complaints of its depredations in England where it has so long been a common bird?" Frequent complaints *are* made in England regarding it, and measures urged for its destruction. In recent reports issued there, especially those published by that well known and talented authoress, Miss E. Ormerod, we find serious charges recorded. One writer states that the sparrow has greatly increased in England during the past ten years, that large flocks of them sweep down on the wheat fields devouring and destroying a considerable proportion of the grain. It is estimated that one million pounds sterling would not repay the farmers of England for the yearly loss sustained through the depredations of this quarrelsome pest. Besides the direct injury thus occasioned, it is said that sparrows prevent the increase of swallows, and drive the soft-billed insect-eating birds, which feed largely on the eggs and larvæ of insects, from the gardens and orchards, while they seldom eat a caterpillar. Another bears evidence of having seen a field of wheat so utterly ruined by legions of sparrows that it was left uncut; and many other similar instances are cited. It is highly probable that we shall in the future have many occasions to regret that this bird was ever introduced into Canada.

During the past year some interesting facts have been published bearing on the retarding influences of cold on the development of insects, as seen in the Arctic regions. These observations have extended over several years, and show that butterflies which, in the warmer regions of the earth, pass through all their transformations once or more in a season, take two or three years to complete a single cycle where the summer season is very short and the prevailing temperature low.

Besides the report of our own Society which contained much useful and practical information, there has been issued in Canada since I last addressed you, a preliminary report by the Dominion Entomologist, Mr. Jas. Fletcher, containing some useful records of work done during the year, and plans for more extended usefulness in the future. It is cause for sincere regret that our esteemed fellow-labourer has in consequence of a severe affliction been obliged to postpone the completion of some of his cherished plans, and thus the completion of work begun with much vigour and promise has been unavoidably delayed. We sincerely hope that he may soon be entirely restored, and thus be enabled to carry on with increased efficiency the work he has undertaken. In addition to the excellent annual report of Miss Ormerod, which has already been noticed, there has been issued in England a useful pamphlet on "insects injurious to hop plants", prepared for the Agricultural Department of Great Britain, by Chas. Whitehead. This issue is to be followed by others on grain, root and fruit crops, and it is sincerely hoped that the issue of these publications will awaken in the minds of the Agriculturists of Great Britain, a livelier interest in the importance of the study of economic entomology. In the United States much has been done. The Entomological Bureau in Washington, under the able direction of Prof. Riley, has most efficiently continued its good work by investigating insect pests in all parts of the United States, and in endeavouring to devise useful measures for their destruction. The reports issued during the past year have been most valuable, and are profusely illustrated. The annual report of Prof. Forbes, State Entomologist of Illinois, is especially worthy of notice. Very excellent papers on Economic Entomology have also been published by Prof. J. A. Lintner, State Entomologist of New York; Prof. A. J. Cook, of Lansing, Michigan; Prof. Hubert Osborn, of Ames, Iowa, and others.

Mr. Wm. H. Edwards, of Coalburgh, W. Va., has published a revised catalogue of the *Diurnal Lepidoptera* north of Mexico, and has continued the publication in parts of

his magnificent work. His observations on the published in the north of *Coleoptera* of A

Some indications of any community, by *doptera* found in Canada have made our Society published known was sixty-six this great increase tains, and North-V Columbia. These most successful. *Diurnal Lepidoptera* trious entomologist Mr. W. H. Harrington, *Hymenoptera*. We similar way our *Di* able to form some i

The following for the ensuing year:—

President—Mr

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Mr. Fletcher in privilege to perform eminently practical after year, each one many points of more to one or two connect the past season. An found a small species among currants, part berries being destroyed



his magnificent work on the Butterflies of North America. He has also continued his observations on the life histories of American butterflies, the results of which have been published in the monthly organ of our Society, the Canadian *Entomologist*. A new list of *Coleoptera* of America, North of Mexico, by Samuel Henshaw has also appeared.

Some indication is given of the progress being made in the study of Entomology in any community, by the extent of information recorded in reference to the *Diurnal Lepidoptera* found in such district. If such an indication may be taken as reliable, we in Canada have made much progress within the past few years. Twenty years ago, when our Society published its first list of Canadian butterflies, the number of species then known was sixty-six, now our lists contain no less than 210. For a large proportion of this great increase we are indebted to the labours of Mr. G. Geddes, in the Rocky Mountains, and North-West Territories, and to those of Mr. James Fletcher in British Columbia. These gentlemen have been indefatigable in their work, and at the same time most successful. While there may not now be many more laurels to gain among the *Diurnal Lepidoptera*, there are other inviting departments of labour in which any industrious entomologist may add much to our present knowledge. We are glad to know that Mr. W. H. Harrington is making good progress in the collection and study of our *Hymenoptera*. We hope that some of our members will be induced to undertake in a similar way our *Diptera*, *Neuroptera*, *Hemiptera* and *Orthoptera*, so that we may soon be able to form some idea of the richness of our territory in these long neglected orders.

WM. SAUNDERS.

#### ELECTION OF OFFICERS.

The following named gentlemen were then duly elected as officers of the Society for the ensuing year:—

*President*—Mr. William Saunders, London, Ontario.

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

*Secretary-Treasurer and Librarian*—Mr. E. Baynes Reed, London, Ontario.

*Council*—Mr. James Fletcher, Ottawa; Rev. T. W. Fyles, South Quebec; Mr. J. Alston, Moffatt, Hamilton, Ontario; Mr. W. H. Harrington, Ottawa; and Mr. C. J. Bowles, Montreal.

*Editor "Canadian Entomologist"*—Mr. Wm. Saunders, London.

*Editing Committee*—Rev. C. J. S. Bethune, Mr. J. M. Denton, Mr. Jas. Fletcher and Mr. E. Baynes Reed.

*Auditors*—Mr. W. E. Saunders and Mr. H. P. Bock.

*Delegate to "Royal Society"*—Mr. W. H. Harrington, Ottawa.

On motion of Mr. James Fletcher, seconded by Rev. Thomas W. Fyles, a vote of thanks was unanimously tendered to the President for his very able address.

Mr. Fletcher in proposing this vote said that as Vice-President he considered it his privilege to perform this pleasant duty. The addresses of Mr. Saunders were always eminently practical and useful, and it seemed to him that as he listened to them year after year, each one surpassed all its predecessors in these characteristics. There were many points of more than usual interest in this address, but he would like to refer briefly to one or two connected with which some curious facts had come under his notice during the past season. An *Anthonomus* had been mentioned as attacking strawberries, he had also found a small species of the same genus committing considerable damage at Ottawa, among currants, particularly the white grape currants. As many as from three to six berries being destroyed in each branch in some gardens. With reference to the injurious

*Anthomyia* of the cabbage he would like to hear the experience of some of the members present as to the efficiency of the remedy so highly recommended by Miss Ormerod, namely, gas-lime. He had himself used it with the most satisfactory results in dealing with this difficult insect. The method adopted had been to sprinkle it lightly between the rows as soon as the young plants were pricked out.

Referring to the President's remarks about sparrows, he wished to record one instance where he had seen them undoubtedly feeding upon *Aphides*. It was after most of the leaves had fallen, and he had distinctly seen a flock of sparrows on an apple tree eating the *Aphides* from beneath the curled up leaves. They were quite tame and allowed him to stand close to them for a long time watching them. It was so seldom one could say a good word for these little fellows whose sole good quality seemed to be their pluck, that he hoped the meeting would forgive the digression, which it was, because unluckily, this was, as far as he knew, a rare occurrence and of very small importance when compared with all the harm they did. Before sitting down he had another very pleasant task to perform which was to present to the Society from that lady herself a large panel likeness of Miss Eleanor A. Ormerod, one whose name was well-known to them all, and with whom some present were fortunate enough to be personally acquainted. It was especially pleasing to see any lady take up the study of entomology; but Miss Ormerod had devoted herself to it so assiduously and with results so important to the farmers of England that she had now raised herself to the eminence of one of the first economic entomologists of the whole world.

In speaking of the wish of the Dominion Government that the Society's collection should be sent to England next spring, he thought that this matter should be most carefully considered. He was aware that this was an occasion for Canada to shew what she could do and was worth, such as would not occur again for a great many years—for this reason he considered it every one's duty to do whatever he possibly could to make the exhibit sent from Canada as good as possible; but he could not help thinking that now the Society's collections were so large and valuable, that after they returned from this exceptionally important exhibition, some rule should be made against the collections again leaving the Society's rooms. The risk of moving these delicate specimens was so great, and the recompense for doing it so small, that he thought it should not be done any more. He was sure that as soon as members knew what was wanting in the cabinets they would gladly give rare specimens to the society where all could see them in the general collection, rather than have them buried in any private one. He had brought a few rare species to the meeting with this purpose, but did not care to leave valuable specimens unless sure, as he was now, that they would be properly taken care of.

Mr. Fletcher exhibited the following specimens:—

*Gortyna Cataphracta*, specimens of which he had succeeded in breeding this year for the first time. It had been very destructive during the three last seasons boring into the stems of many kinds of plants, more especially lilies and raspberries. (Presented to the Society.)

*Calocampa vetusta*, bred from larva found feeding on *Comandra pallida*, at Spence's Bridge, in the interior of British Columbia, also specimens found at Ottawa.

A fine pair of *Tolype velleda*, bred from larvæ, fed on elm. (Presented to the Society.)

A specimen of *Pyrameis Atlanta*, of which the larva had been fed on elm, after the third moult.

Specimens of *Platyserura furcilla*, bred from larvæ, on *Pinus strobus*.

Specimens of the cases and pupæ of *Incurvaria acerifoliella*, which had occurred at Ottawa in enormous numbers this year, defoliating the leaves of the sugar maple, *Acer saccharinum* var. *nigrum*. This insect makes a curious case for itself by cutting out a circular piece of the leaf.

Several rare specimens taken in British Columbia. Specimens of *Chlamys polycoeca*, bred from larvæ, taken on *Rubus villosus* var. *humifusus*.

A fine specimen of *Pityobius anguinus* taken at light at Ottawa. (Presented to the Society.)

A specimen of *Pecilinota cyanipes*, at Ottawa on a dead aspen stump.

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A specimen belonging to the *Elateridae*, which he had taken in British Columbia, in the act of destroying *Aphides*.

A small *Aleochara* bred from the puparium of *Anthomyia ceparum*, at Ottawa.

The Rev. T. W. Fyles seconded the motion, and spoke of the value of the President's address, and the appreciation which it received from the members of the Society.

On the motion of Mr. E. Baynes Reed, seconded by the Rev. C. J. S. Bethune, the Society resolved :

"That the hearty thanks of this Society be tendered to Miss Eleanor A. Ormerod for the beautiful photographic portrait of herself received through the Vice-President Mr. James Fletcher ; and that the Society desires to place on record its grateful appreciation of the indefatigable work of Miss Ormerod in practical entomology, and the vast services she is rendering to British agricultural interests ; and that the Secretary be instructed to have the portrait suitably framed and placed on the walls of the Society's room, and to send a copy of this resolution to Miss Ormerod."

The Rev. C. J. S. Bethune in seconding the resolution spoke of Miss Ormerod's work and the pleasure he had received from a personal acquaintance with her, and pointed out how through her efforts the English Government were introducing the system of having a departmental officer whose attention should be given to practical entomology.

The President stated that although no representative had been sent from the Society to Ann Arbor meeting, yet through the kindness of Mr. J. B. Smith, the Secretary of the Entomological Club of the A. A. S., a brief synopsis of their proceedings had been received and would appear in the pages of the *Entomologist*.

After some further discussion the Society adjourned at 10.15 to meet next morning at 9.30.

OCTOBER 14th, 1885.

The Society reassembled Wednesday morning at 9.30.

About an hour was spent by the members in examining the cabinets and library, and exchanging notes and information.

Business was resumed at 10.30.

The following communication was received.

MONTREAL, October 10th, 1885.

MY DEAR MR. SAUNDERS,

Favoured by the kindness of Mr. Bowles I send you a few Diptera for the Society's collection. You may rely on the names, as I have compared them carefully with specimens determined for me by Dr. Williston. You probably possess them already, but as the Society's list of the order is so small, I venture to send them. I also put in some *Physonota unipunctata*, Say var. *5 punctata* (Walsh and Riley), which is I think, nothing but *Helianthi* (Rand). I have reared it from larvæ this season found in different stages of growth on *Helianthus decapetalus*. If there are more than you require for the Society's collection, please divide with any who wish for them. I will soon send you some notes on this species for the *Canada Entomologist*. I am very sorry that I cannot attend the meeting, and wish you all a pleasant and successful gathering.

Believe me,

Yours faithfully,

F. B. CAULFIELD.

This donation was most thankfully received, and a vote of thanks therefor was unanimously passed to Mr. Caulfield.

A communication was read from Mr. W. D. Shaw, of Montreal, with a donation of a fine specimen of that rare moth, *Hepialus Thule*, Strecker. Mr. Shaw had been successful in obtaining during the season, nine specimens.

A vote of thanks was given to Mr. Shaw.

## Papers on Entomological subjects:—

No. 1.—A paper was read from J. A. Guignard, B.A., of Ottawa, on the most interesting forms of *Hymenoptera* in the vicinity of Ottawa.

The Editing Committee were requested to publish the paper in the *Entomologist*.

Paper No. 2.—By Mr. H. H. Lyman, of Montreal. Notes on the genus *Callimorpha*. The paper was illustrated by well executed coloured drawings of the various forms of this interesting genus. Letters were also read received by Mr. Lyman from Mr. Butler, of the British Museum. This paper has been returned to Mr. Lyman, who intends publishing it in the *Entomologist*, when he has obtained some further information for which he is seeking.

Paper No. 3.—Notes on the same genus, by Mr. F. B. Caulfield, of Montreal. This appears in a subsequent part of this report.

Mr. Harrington had reared larvæ which proved to be *militaris*, and fed on *ribes* (wild currant). Mr. Fletcher had bred them on *cynoglossum* (hound's tongue).

Paper No. 4.—Notes on *Tenthredinidae*, by Mr. W. H. Harrington, of Ottawa.

This will appear in the *Entomologist*. Rev. Mr. Fyles said that a curious circumstance had come under his observation this season. He had noticed a solitary wasp, *Odynerus capra*, swoop down upon a batch of larvæ of *Nematus ventricosus*. On the approach of the wasp, the larvæ, conscious of danger, dropped instantly to the ground. But the enemy was not to be foiled. It descended also, and, having selected a victim, overcame its struggles by nipping it systematically joint after joint, through all its length. It then attempted to fly off with the spoil, but finding it too cumbersome took measures to lessen it. Commencing at the head, it devoured the more succulent parts of the foremost segments, rejecting the skin and the members, which it severed from the rest. There was then left the compact afterpart of the body. This the creature seized and flew away with, intending probably to provision its nest therewith.

In referring to *Nematus erichsonii* he stated that the insect had again been abundant at Quebec, and that tamaracks that had survived the attack of last year, now showed tokens of decay, some of the branches only putting forth a second crop of leaves, and that but a sparse one. The cocoons of the insect were very abundant under boards, etc., near the trees affected.

Paper No. 5.—Note on an injurious saw fly larva, by Rev. T. W. Fyles.

This insect had been noticed in large numbers on the paper birch, *Betula papyracea*. The paper will appear in the *Entomologist*. Mr. Harrington had found the same species of larvæ feeding on the black cherry, but failed to raise them from the cocoon. They feed on the edge of the leaf.

Mr. Moffatt had found *Cimbez Americana* had gone over to the second year before transforming and emerging from the cocoon.

Mr. Fletcher thought that this was an effort of nature to perpetuate the species; he had noticed a similar habit in a *Dipteron*, *anthomyia ceparum*.

In *Nematus erichsonii* he had noticed the flies perfect in the cocoon, but not able to emerge, possibly because in spring they had not sufficient moisture to soften the cocoon.

The lateness of the season having been noticed, Mr. G. Geddes remarked that he had seen double broods of *Ctenonympha inornata*, and that *crysophanus thoe* could be obtained now, though in swampy places hard to get at.

The President reported the capture of *Fenisca Tarquinius* at Stoney Lake in August; he had not taken *Neonympha canthus* later than August 1, and usually in June and July.

Mr. Geddes said he had captured both *Eurytris* and *canthus* in September.

Mr. Moffatt thought that most of the butterflies this season had been unusually late.

The President expressed the opinion that temperature was the important factor in modifying the date of appearance of insects, the climate determining whether it consists of one or more broods.

Mr. Geddes stated that members would confer a great benefit on entomological research by keeping memoranda of the exact date of the appearance of our butterflies.

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Paper No. 5  
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Mr. Jas. F. Smith  
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Mr. Fletcher corroborated this statement, and wished to enjoin on members the importance of keeping as full a record as possible of every insect that they captured.

Mr. Saunders stated that Mr. W. H. Edwards, of Virginia, wished to ascertain if any member had noticed the larvæ of *Papilio Turnus* feeding on willow.

No member present had observed it.

A communication was received from Mr. W. H. Ashmead, of Jacksonville, Florida, enclosing a partial list of North American *Hemiptera*, and desiring to exchange with Canadian collectors.

Mr. Ashmead has nearly ready for publication a catalogue of the described N. A. *Hemiptera*, numbering now 4,000 species.

At one o'clock the society adjourned to 3 p.m.

At 3 p.m. the Society reassembled, the Vice-President, Rev. C. J. S. Bethune, in the chair.

Paper No. 6.—On butterflies, by Rev. T. W. Fyles. This will be found at length in a subsequent part of this report.

Paper No. 7.—Note on *Oryssusi Say*, by W. H. Harrington, Ottawa. This will be published in the *Entomologist*.

This rare insect was captured at Ottawa, running up and down on a telegraph pole.

Paper No. 8.—Notes on *Euchaetes Egle*, by Mr. G. H. Bowles, Montreal.

Mr. Bowles exhibited specimens of *E. Egle* and *collaris*, with an albino form of the former. His notes illustrated the distinctions between the two species.

Paper No. 9.—Note on *Xiphydria albicornis*, by Mr. W. H. Harrington.

This insect was observed infesting the maples near Ottawa. The notes will be published in the *Entomologist*.

At 6 o'clock the Society adjourned to meet at 8 p.m.

8 o'clock p. m., the President in the chair.

Paper No. 10.—*Tenthredo (?) delta. Proc.*, by Mr. W. H. Harrington, will also appear in the *Entomologist*.

Mr. Jas. Fletcher, at the request of the President, gave an account of part of his trip to British Columbia, in which he gave a most graphic and interesting description of the trees, plants, and insects found at Victoria in the month of June, and on Mount Finlayson, the locality where the original specimens of that rare butterfly *Chionobas gigas* were taken.

Discussion then took place on the forms of labels for insects. It was suggested that a label should be printed with blank spaces to contain the name of the collector, the locality of capture and date.

It was decided to leave the matter in the hands of the Council.

The preparation of the annual report was discussed, and after some further examination of the cabinets, this most pleasant and successful meeting was brought to a close, and the Society adjourned at 10.15 p.m.

## POPULAR PAPERS ON ENTOMOLOGY.

THE RASPBERRY SAW-FLY (*Selandria rubi* Harris).

BY WM. SAUNDERS, LONDON, ONT.

This destructive insect appeared in great force during the past season in many parts of our Province, doing much damage to the foliage of raspberry plants. Although in form and habits the larva of this insect much resembles the currant worm, it is not nearly so well known, nor is it usually so promptly recognized. There are several reasons for this. The raspberry saw-fly does not appear in such flocks as the currant worm, because the eggs are laid singly and not often near together; nor is the larva easily detected owing to the fact that in colour it so exactly resembles that of the leaf on which it feeds.

The eggs are oval, yellowish white and semi-transparent, and are buried beneath the skin of the raspberry leaf near the ribs and veins, placed there by means of the saw-like apparatus situated at the extremity of the body of the female, by which slits are cut in the tissues of the leaf. The skin covering the egg is so transparent that the movements of the enclosed larva may be observed several days before it is hatched. It escapes through an irregular hole made on one side of the egg.

The newly-hatched larva is about one-twelfth of an inch long, with a greenish-white head having a black eye-like spot on each side. The body is nearly white and semi-transparent and thickly covered with transverse rows of white spines. As it grows older the colour changes to green, and when full grown it measures about three-quarters of an inch in length and appears as shown on the leaf in figure 1. The body then is of a dark green colour, and is thickly set with pale green branching spines. In figure 1 some of the segments of the body are represented, magnified, showing the arrangement of the spines on the back and side. The head is small, of a pale yellowish green colour, with a dark

brown dot on each side. The eggs are laid near the tips of the growing canes, and the larvæ are usually found feeding on the upper surface of the young leaves. When full grown, which is generally from the middle to the end of June, the larva leaves the bush and descends to the ground, where it penetrates beneath the surface and constructs a small oval earthy cocoon, mixed with silky and glutinous material. The larva remains unchanged within the cocoon for a considerable period but finally transforms to a chrysalis from which the perfect insect is produced the following season.



FIG. 1.

of the raspberry begin to appear. The wings, which are transparent with a glossy surface and metallic hue, measure when expanded about half an inch across; the veins are black and there is a streak of black across the front margin, extending more than

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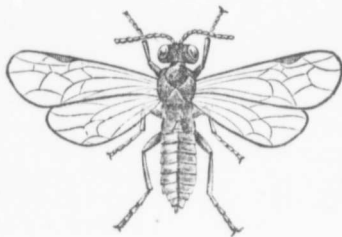
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half way towards the tip of the wing. The anterior part of the body is black, the abdomen of a dark reddish hue. Early in the morning when the air is cool these flies, when approached, will fall from the bushes to the ground and remain inactive there long enough to admit of many of them being caught and destroyed, but as the heat of the day increases they become much quicker in their movements, and when disturbed take wing readily.

The larvae may be promptly destroyed by syringing the bushes with water in which powdered hellebore is mixed in the proportion of an ounce of the powder to a pailful of water, or with Paris green and water in the proportion of a teaspoonful of the poison to a pailful of water.



#### ENTOMOLOGICAL NOTES.

BY J. G. JACK, CHATEAUGUAY BASIN, QUEBEC.

The following notes on the habits of several insects are from a record of entomological observations kept during the past four years, and although imperfect, they may serve as a hint to others to pursue observations in the directions indicated.

During the past season few unusual specimens were taken and very few notes made. Diurnal Lepidoptera (with the single exception of *P. cardui*, which had been rare for some years) were unusually scarce. *Pieris rapae* is becoming less numerous every year, owing, probably, to its many parasites. Moths were not so abundant as usual, and the only capture worthy of notice was the re-occurrence of *Aletia xyliana* Say (the cotton-worm moth), a single good fresh specimen of which was taken October 26th, in the woods, among leaves near a butternut tree. There had been severe frost the night before, but the moth was quite lively when found. Looking through my note book, I find the following entries regarding this insect:—

“October 1st–15th, 1881. Found *Aletia xyliana* Say quite common, especially in open barrels or heaps of decaying apples left in the orchard.”

“Sept. 21, 1882. *Aletia xyliana* Say taken at decaying fruit.”

“Oct. 12, 1883. *Aletia xyliana* Say taken at decaying apples. Not very common this year.”

The decaying apples mentioned were windfalls that had been partly eaten by other insects before they were gathered, and put into heaps or old barrels to be fed to cattle. When these apples had stood in the sun a few days, the smell of ripe fruit from them became quite strong, and many moths, flies, etc., were attracted. It was here I found *Aletia xyliana* most common, resting quietly on the bitten apples, and easily taken with the hand. They are nearly always in good condition, and although they are not easily “rubbed” and have the power of long sustained flight, I find it hard to agree with Professor Riley’s opinion that they fly here every autumn from the Southern cotton fields. I think we will yet find there is a Northern food plant.

Dec. 30th, 1881. Found more than one hundred pupæ of *Drasteria erectea* Hub. in a hollow piece of wood. They must have been collected and placed here by some small animal, possibly a wood-mouse.

Jan. 9, 1882. Found several examples of hibernating *V. milberti* under stones in a stone fence. I thought it worth noting that two or more were almost always found under the same stone or near together, and a considerable distance might intervene between each lot of specimens.

July 25, 1882. Several specimens of *V. antiopa* taken hovering over bushes of choke-cherry (*P. virginiana*), the leaves of which were much infested with aphides. The

butterfly would alight on the curled leaves containing the aphides, and extending its tongue, insert it among them, and when engaged drinking the sweets furnished by the aphides, it could readily be taken with the hand. *Limnitis arthemis* and *L. disippus* were observed and taken similarly occupied. At a meeting of the Cambridge Ent. Club (Jan 12th, 1883) I asked the members present if they had observed or known of such habits in these butterflies before, and received a negative reply. Also notice that *Phyciodes tharos* and other small red butterflies sometimes persistently follow *D. archippus* and other large butterflies of the same colour. They alight when the large butterfly does, rising only when the larger insect takes to flight again. Is this for the sake of protection from some enemy?

The following note was made at the Experiment Grounds of the "Rural New-Yorker," River Edge, Berken Co., N. J.:

"July 7, 1883. Found *Pronuba yuccasella* Riley in flowers of *Yucca filamentosa*. They are quiet during the daytime, but become active in the evening. Have not found them anywhere except in or upon flowers of this plant. Also observed a Humble-bee succeed in entering two or three of the flowers, and clasping the stamens firmly with its legs, it reached the base of them with its tongue and usually went two or three times around. It had much difficulty in getting into the flowers. No other insects were observed about them. Could this bee fertilize *Yucca* flowers?

June 25, 1884. Found a young pear tree almost entirely defoliated by larvæ of *Vanessa antiopa*. I have never heard of the pear as a food plant of this insect.

Aug. 24.—I noticed an ichneumon fly (*Ophion*) attempting to deposit eggs in or upon a larva of *Notodonta concinna*. After finding the position of the caterpillar, the *Ophion* brought its head pretty close to it, and then brought its abdomen and ovipositor up under its thorax and between its legs, apparently using its mandibles as a sort of guide or brace for the ovipositor. The *Ophion* was seen to probe the thoracic legs of the caterpillar with its piercer, but for what purpose I could not make out. The caterpillar was very much excited. For want of time I was obliged to give up further observation, and killed the specimens.

Aug. 25, 1884.—The Buffalo tree hopper (*Ceresa bubalus* Fab.) is very abundant on the branches and trunks of young apple and pear trees, depositing eggs beneath the bark. They are sometimes so numerous as to literally cover the limbs of the trees, and the cutting up of the bark must do considerable injury.

Sept. 22, 1884.—Found a larva of *S. drupiferarum* which was infested by parasites, which could be plainly seen just below the skin. An hour after it was taken, I looked at it again, and found nearly all the parasites making holes in the skin, one of them already having its body half through the hole just made. I put the larva in a paper bag and did not look at it again for two days, when I found it still living, but weak, and with circular marks on its back showing where the parasites had made their exit. In the bag I found a bunch of small cocoons, set side by side, on end, like the cells in honeycomb, all being firmly cemented together by a tough brownish substance.

## WHITE ANTS DESTROYING LIVING TREES AND CHANGING THE FOLIAGE, IN CAMBRIDGE, MASS.

BY H. A. HAGEN, CAMBRIDGE, MASS.

The common white ant, *Termes flavipes*, destroys dead wood, stumps of trees and timber, just as does its nearest relative, *T. lucifugus*, in Europe. Of the latter species some cases are reported where living pines and oaks have been destroyed in the South of France. For *T. flavipes*, only one case is known, in which living grape vines in a hot house in Salem were injured. (S. H. Scudder, Proc. Boston, N. H. S., vol. 7, p. 287). Now the earth in the hot houses here in Cambridge is greatly infested by white ants, but as far as I know, no destruction of plants has been observed. I was very much interested by

the information that were largely infested, apparent by the separated, more condition, except somewhat the appearing parts of the collected, and in open gangs, cover feet or more. The uninhabited estate the whole estate track covered with As the boards of side instead of on old, the stables are to be entirely free able. Mr. Sereno to determine the known species. I common *Acer rubrum* the leaves of the more than two inches than the side lobe: the red maple. The foliage of the feet, broke down considered safe to up along the tree, was only two feet but no more than the wood perfectly meter in the middle squirrels, had black sequence of those perhaps the injury observations are made to me.

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the information from Mr. W. F. Putnam that in a garden in Irwing street living maples were largely infested by white ants. The evidence of the truth of this information was apparent by the first glance at the trees. They were three in number, some few yards separated, more than sixty feet high, two feet diameter at base, and apparently in good condition, except that the bark was in certain places affected or split. Those places had somewhat the appearance of the well-known winter splits of the bark of trees. In removing parts of the bark, directly living white ants, workers and a few soldiers, were found, collected, and proved to belong to *T. flavipes*. Closer observation showed that small open gangs, covered outside by the loose bark, ran along the tree to a height of thirty feet or more. There were on this estate no old rotten stumps, but some of the adjacent uninhabited estates contained them, where probably the nest may be found; nevertheless the whole estate was so overrun by white ants that they had made along the fence a long track covered with the hard clay-like mud with which they usually fill the eaten parts. As the boards of the fence were thin, it was perhaps judged safer to build the canal outside instead of on the interior of the boards. The house, a framehouse, about ten years old, the stables and the wooden sheds were entirely intact. The estate near to it seemed to be entirely free from the pest. The foliage of the infested trees looked very remarkable. Mr. Sereno Watson, the curator of the Cambridge Herbarium, was at first at loss to determine the leaves; the size, the shape and the venation would not agree with any known species. But when he saw the tree, he was directly sure that it was only the common *Acer rubrum*. Some fresh shoots near the base of the tree had unmistakably the leaves of the common red maple. All the other leaves were very small, mostly not more than two inches broad, the midian lobe often short, sometimes blunt and not longer than the side lobes; the ribs below were about yellowish and decidedly less dark than on the red maple. The owner of the estate had for ten years not observed any change in the foliage of the trees. During the last winter the upper part of one tree, some twenty feet, broke down in a gale, and proved to be not infested by white ants. Now it was considered safe to fell the whole tree. The bark was, in the place where the gangs went up along the tree, extensively bored and hollowed by the white ants. The wood itself was only two feet above the ground, filled with the common white ant holes and gangs, but no more than one inch deep around the stump. The inner part of the tree showed the wood perfectly sound for thirty feet, except a perpendicular hole of two inches diameter in the middle of the tree, going down to the root. This hole, perhaps made by squirrels, had black ants as inhabitants. The two other trees are still standing. In consequence of those facts, I looked around in Cambridge, and have now the suspicion that perhaps the injury done to living trees may be less rare than I had supposed. If similar observations are made by entomologists, I would be thankful to have them communicated to me.

## PROBABLE ORIGIN OF THE WORD "BUTTERFLY."

BY FREDERICK CLARKSON, NEW YORK CITY.

The transformation of a grovelling worm to the glory that attaches to the winged aspirant of the heavens, has won for this insect from remote antiquity the appellation of Spirit or Soul, as typical of the resurrected human body. There is, I think, good reason to believe that the root meaning of the word "butterfly" dates back to early Egyptian history, and as a hieroglyphic it is synonymous as representing the qualities of completeness and perfection which characterize the soul. I have supposed that it might serve the interest of this journal to record such historical gleanings bearing upon this subject as have come within my reach. It is said that in Yorkshire in England, the country folk call the night-flying white moths, Souls. This restricted application of the term very forcibly expresses what had been traditionally received by these people, and which they unwittingly have applied to certain white winged species. The English word "Moth" is said to be the Egyptian "mutt" or "mat." "Mat" is to pass; "mut," to die;

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"matt," unfold, unwind, open, as the chrysalis entered the winged state and passed. The winged thing was a symbol of the soul; it appears in the hieroglyphics as the moth or butterfly. The common view, we know, originates the word with the yellow Diurnae as illustrated in the butter-colored wing of the genus *Colias*. The word butter is supposed to be derived from "put" (Eg.), food; and "ter" (Eg.), made, fabricated. The butterfly may be the type "put" (Eg.), "ter," complete, perfect. Thus in death ("mut") the soul passed, unfolded like the moth, whose chrysalis showed and was the type of the process, whence the butterfly. Calling the moth a soul identifies the imagery as Egyptian. In Cornwall, England, departed souls, moths and fairies are called "piskeys." Piskey is the same as psyche, and both are derived from the Egyptian, in which "khe" is the soul, and "su" is she; hence the feminine nature of the Greek "p-su-khe." Without the article, "sakhu" is the understanding, the illuminator, the eye, and soul of being, that which inspires.

The ancients evidently were not very good entomologists, for this original meaning, beautiful as it is, is altogether incompatible with the teachings of the modern science, for in these days we realize that the so-called spiritual life, as represented by the butterfly, is but a span in comparison with the earthly life, as illustrated by the larva, and that the heavenly aspiration and grace which mark the shorter life are the outcome of a comparative eternity of rioting and waste; yet, be it said, the silk worm at the eleventh hour makes a good record.

"Well were it for the world, if all  
Who creep about this earthly ball,  
Though shorter-lived than most he be,  
Were useful in their kind as he."

Moreover, who that has ever attempted to capture a *Limenitis arthemis*, but has learned to his cost, that though a thing of beauty, and its possession a joy for ever, its habits are deceitful. Well do I remember a chase for this butterfly—the first that I had ever seen on the wing. It was a royal game of tag, with hide-and-go-seek variations. We saw-sawed up and down a ravine for nearly an hour. When first discovered it was regaling itself in the sunlight, upon a leaf about half way down the opposite bank, all the while jerking its wings, after a fashion, as if beckoning me over. By the time I had worked my way down over the rocks and through the briers, it was spreading its wings on the bank I had just left, and when I returned it was away again to its favorite leaf on the other side. Tired and heated, I gave up the chase, when the *arthemis*, in a most provoking way, lit upon a shrub beneath my very nose. This coquettish insect apparently realized my discomfiture, and after repeated approaches and withdrawals, it rose on wing and with

"The light coquettes in sylphs aloft repair  
And sport and flutter in the fields of air."

#### ENTOMOLOGICAL EXHIBITS AT THE NEW ORLEANS EXPOSITION.

BY WM. SAUNDERS, LONDON, ONT.

The United States Government exhibit, and those of several of the States, at the New Orleans Exposition, included many features of interest to the Entomologist. The Entomological Bureau of the Department of Agriculture had a very fine display illustrating Economic Entomology, which was brought together and arranged under the direction of Prof. Riley, and was not only interesting, but very instructive.

The first thing that caught the eye of the visitor on entering this section was a series of large diagrams on cotton, illustrating the life history of a number of injurious insects, such as the Plum Curculio, *Conotrachelus nenuphar*, and its parasites; the Chinch Bug, *Micropus leucopterus*; the Jumping Sumach Beetle, *Blepharida rhois*; the Boll Worm, *Heliothis armigera*; the Round-headed and Flat-headed Apple-tree Borers, *Saperda candida* and *Chrysobothris femorata*; the Codling Moth, *Carpocapsa pomonella*; the Peach Borer, *Aegeria exitiosa*; the Grape Phylloxera, *Phylloxera vastatrix*, and a large number of other

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well-known injurious species. The insects themselves were arranged in cases near by, and grouped so as to shew those injurious to the apple, pear, peach, orange, strawberry, raspberry, currant, gooseberry, melon, cranberry, persimmon, grape, sugar cane, hop, rice, Indian corn, small grains, cotton, grass, clover, pea, bean, cabbage, potato, tomato, tobacco, asparagus and onion. Many of these groups were very complete, having along with the perfect insects the pupæ and blown larvæ, with specimens of the articles injured, also the friendly insects which aid in subduing those which are injurious.

There was a very interesting section relating to bees and bee-culture, including all sorts of hives and apparatus, specimens of the different races of bees, with dried specimens of the plants and flowers from which honey is chiefly extracted.

A large department was filled with every kind of spray apparatus for applying liquid poisons to growing crops for the purpose of destroying injurious insects.

The silk exhibit was also very instructive, shewing this substance in all stages of manufacture from various species of silk worms, including some of our natives.

A very complete catalogue of the exhibit had been prepared, covering ninety-five pages 8vo., which was freely distributed to those specially interested in the subject.

In the Florida exhibit there was one case of insects containing a number of butterflies and beetles, including some beautiful Papilios, the only familiar species being *crasphontes*. There were no names to the specimens, and nothing to indicate who they were collected by.

North Carolina shews four cases of insects without names, including some very handsome species of Lepidoptera, Coleoptera and Neuroptera.

In the Texas department there was a gorgeous display, the collection of H. L. Heiligbrodt, of Bastrop, Bastrop Co., Texas, consisting of twelve cases of Coleoptera and twelve of Lepidoptera, classified and named, including some of the most brilliant and perfect specimens ever seen by the writer, with wonderful metallic lustre. Mr. H. also exhibited forty-three cases of European insects.

The State of Mississippi shews one case of insects fancifully arranged, collected by Miss P. Crump, including all orders, among them some rare and interesting butterflies.

In the Maryland exhibit, Mr. E. Louis Graf, of Baltimore, has a very singular looking display consisting of several cases of insects with the specimens arranged in fanciful designs and representing objects such as the American eagle, etc.

In the woman's department there was a collection of galls by Miss Cora H. Clarke, of Boston, in eight cases; also a series of excellent drawings of insects and parts of insects by Mrs. A. B. Comstock.

Among the exhibits from Japan there were quite a number of insects shewn by the educational department, consisting of four cases of Lepidoptera, including some very beautiful diurnals and handsome moths. The only familiar butterfly here was that cosmopolitan species, the Painted Lady, *Pyrameis cardui*. There were two cases also of Coleoptera, containing some handsome longicorns, one case each of Neuroptera, Hemiptera and Orthoptera, and one of mixed Hymenoptera and Diptera.

In addition to these there were two large cases where the specimens were grouped so as to shew those injurious and those beneficial to agriculture.

There were probably other collections of insects in the buildings, but there being no official catalogue to guide the visitor, there was great difficulty in finding them.

## ENTOMOLOGY BY THE ELECTRIC LAMP.

BY PROF. E. W. CLAYPOLE, AKRON, O.

During the past winter an installation of about 100 arc-lamps was established at Akron, O. They hang as usual over the middle of the street. Early in the summer it was evident that they would afford a fine hunting-ground for the entomologist, and accordingly several members of the Natural History Society of Akron resolved to turn the opportunity to account by making collections of the insects attracted by the light and comparing and noting the results.

I have not yet ascertained what others have done, but the following notes of my own observations may interest some readers of the *Entomologist*:

At the opening of the season the Cockchafer (*L. fusca*) was almost the only visitant, but in such numbers that specimens might be collected by the quart for a few evenings. Gradually other species appeared. *Belostoma americanum* and *Calosoma calidum* were conspicuous, the former for its size, and the latter for its beauty. The former has obtained the popular name of the "electric light bug." It is supposed to have appeared with the lamps, and is oftenest brought to me for identification. The grave-digger beetles, *Necrophorus*, *Silpha* and *Hister*, were not infrequent. Why they come to the light is not easy to say. Possibly the carrion which they usually seek is slightly phosphorescent, and attracts them by its glow, and they are deceived by the brilliancy of the electric arc. Several small Carabids were abundant about the same time, but have not yet been identified.

As June advanced moths became more abundant than beetles, not because the latter fell off, but because the former largely increased. On warm evenings a perfect swarm played round the lamps, hour after hour. Every now and then one and another dashed into the globe, struck the glowing carbons, dimmed the light and was killed or consumed with a hissing noise. By morning a handful, sometimes a half pint, of dead insects was accumulated at the bottom of the lamp-glass, mostly scorched and burnt. In this way immense numbers are destroyed, but no apparent diminution ensued. One morning in June I obtained about a hundred specimens of the very abundant little grass moth (*Crambus mutabilis* Clem.) from every lamp examined. This means a destruction of above ten thousand individuals nightly of this one species. As the process has been going on for at least a fortnight, the 102 lamps in this city have killed about 1,500,000 individuals. Yet still they come, and in undiminished numbers.

Since then, Dart-moths (Cut-worms) of various species have begun to appear. About the middle of June I collected above fifty specimens from three lamps. It was apparently *A. subgothica* Haworth, though Riley (*Entomolog. Rep. of Mo.*, 1868, p. 82) says that this species does not appear till September. Positive identification of these moths is often difficult. This implies the destruction of about 1,500 nightly. Other species of Dart-moths not yet identified were equally numerous. One would think such wholesale slaughter must diminish their numbers, and perhaps the results will be seen in future years. If the eggs were laid previously no such result could be expected. But the frequent occurrence of eggs in the collecting boxes shews that this is not the case.

The Tiger Moths (*Arctia*, etc) have been equally abundant, especially *A. virgo*. Were all that I have collected identified, as I hope they soon will be, the list would be long.

The white-lined Hawk Moth (*D. lineata*) with others of the same family, is a frequent visitor. The Water Tiger, *D. marginalis*, with two or three smaller Dytiscids, are often taken. These and most of the heavy fliers strike the globe and fall stunned to the ground, but soon recover unless boxed at once.

The Stag Beetle (*L. dama*) and Fire fly (*P. pensylvanica*) appeared later and less frequently with the great Lebia (*L. grandis*) and *Dichelonycha elongatula*, the latter for a few evenings in great abundance. A single specimen of the Codling Moth was captured.

About the end of June a new fauna began to appear. The Cockchafers had nearly disappeared. But the great Ground Beetle (*H. caliginosus*) supplied the place, and in so great numbers that one evening I filled a four-ounce bottle in fifteen minutes. With it came two, to me, unexpected visitants, the Blister Beetles (*L. vittata* and *atrata*.)

This is but a partial list of the species already collected. Several of the large and conspicuous moths have been met with, and I hope later to send a longer catalogue.

But we are not the only insect hunters about the electric lamp. Every evening the toads congregate until the ground is alive with them, and food is so plentiful that they are sometimes almost unable to return to their holes and often past hopping. Several times also I have suspected the presence of skunks, but have never yet seen a frog. Small boys, too, flock to the lights for the sake of stamping on the cockchafers and other insects that lie disabled on the ground. Between the toads, the skunks and the small boys, the entomologist is sometimes hard put to it, and must work late at nights or

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A special interest in their surroundings is able for the devotees of the weeks in the year run through all

R. McLachlan (vol. xiv.) refers to the development of insects as they take place in

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\* Mr W. H. Edwards, syn. of *Ocniscus borealis* says *Taygete* Hub. = one species.

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betimes in the morning, or both. Could he only in addition to the real insects make a collection of the huge phantasmagoric spectres that fly and creep about the roadway projected by the intense light, he would have an array of "bugges" that might fairly be called "terrors by night."

## INSECTS IN ARCTIC REGIONS.

A special interest attaches to the question of the mode of life in insects in relation to their surroundings in high northern latitudes. Knowing, as we do, that the time available for the development of an insect in the extreme north is limited to from four to six weeks in the year, one has felt surprised how it could be possible for certain species to run through all their transformations in so short a time.

R. McLachlan, in his paper on the insects of Grinnell Land (Jour. Linn. Soc., Zoology, vol. xiv.) refers to the difficulties which the shortness of the summer interposes to the development of insects, and intimates his suspicion that a development which would with us take place in a single summer would there require several summers.

The correctness of this suspicion has been completely established by the interesting observations on species of *Lepidoptera* in South Waranger, in latitude 69° 40', made by G. Sandberg. He was successful in watching the development of some extreme northern species from the egg.

Let us take as an example *Oeneis Bore*, Schn., a true hyperborean butterfly, which has never been found outside the Arctic circle\*, and even there only occurs in places which bear a truly Arctic stamp.

The imago flies from the middle of June onwards, and lays its eggs on various species of grass. The eggs are hatched the same summer; the larva hibernates below the surface of the earth, feeds and grows all through the following summer, but does not succeed in attaining its full size; it then hibernates a second time, and does not assume the pupa state till the spring of the following year.

The pupa, which in the allied forms in more southern localities is freely suspended in the air to a grass stem or some similar object, here reposes in the earth, which in so inclement a climate must evidently be a great advantage.

The butterfly escapes from the pupa-skin after an interval of from 5-6 weeks, a period of unusual length for a diurnal *Lepidopteron*. In more southern lands the pupal repose of butterflies in summer rarely exceeds a fortnight. Hence, the entire metamorphosis is more tedious than in more temperate regions.

By these and other observations, Sandberg shows that one Arctic summer, in latitude 70°, does not suffice for the development of many *Lepidoptera*, but that two or more summers are required for the purpose. If, therefore, more than one summer is needful for the development of *Lepidoptera*, it appears to me even more certain that Humble-bees must require more than one summer. With us it is only the fully developed females which survive from one year to the next; in spring they form the new nest, lay eggs, and bring up the larvæ which develop into workers, and thus begin to contribute to the support of the family, whence at last towards autumn males and females are developed. It seems hardly credible that all this can happen each summer in a similar way at Grinnell Land, in latitude 82°, especially as there the supply of food must be less than with us. Hence, the development of a colony of Humble-bees must there be something quite different.

\* Mr W. H. Edwards informs us that Mr. David Bruce has taken *Chionobas Taygete* Hub., which is syn. of *Oeneis Bore* Sch., in Colorado, on summits, at high elevation. Mr. Edwards' Catalogue, No. 304, says *Taygete* Hub. = *Bootes* Bd., and Staudinger's Cat. says *Bore* Sch. is the same as these, that is, it is all one species.

Were it not satisfactorily established that Humble-bees do occur in such high latitudes, one might from our knowledge of their mode of life, be disposed to maintain that under such conditions they could not live.

They seem, however, to have one advantage over their more southern brethren. In the Arctic regions they do not seem to be troubled with parasites, such as *Conops*, *Mutilla*, which help to diminish their numbers in other countries.

### BIOGRAPHICAL NOTICE OF REV. D. ZIEGLER.

BY DR. H. A. HAGEN, CAMBRIDGE, MASS.

As I have stated in my notice on Melsheimer, nothing is known of his friend, Rev. D. Ziegler, except the publication of a paper on *Coleoptera*. Again, I am indebted for a large part of the notice now given to the untiring kindness of Rev. J. G. Morris, of Baltimore, for many years a friend and correspondent of Rev. D. Ziegler. Nevertheless, desiring to find out something more of this father of American Entomology, I decided to go to York, Pa., and had the pleasure of seeing his wife, Mrs. Ziegler, his son, Dr. H. A. Ziegler, and the brother of Rev. D. Ziegler.

Daniel Ziegler was born June 11th, 1804, in Reading, Berks Co., Pa. His father, and probably his grandfather, were born in America. There is nothing known by the family as to when their ancestors came to America. After he became of age he studied at the University of Pennsylvania for some time. Later he studied Theology at York, Pa., at the German Reformed Seminary, under the presidency of Dr. Mayer. He was married to Miss Eve Eyster, and had ten children, of whom two sons are living. Kraeutz-Creek Church, six miles from York, was his first pastoral charge, which he served thirty-seven years. During eighteen years he took care of eight churches; during twenty-seven years of six churches. Later he retained only four. Afterwards he was elected to the German congregation in York, which he served about thirteen years.

During his ministry in Kraeutz-Creek he began to collect insects and to study entomology. His son told me that he often accompanied his father, and that he collected insects principally by beating in the umbrella, an excellent method, but very little used, as far as I know, in America. One of his churches was very near to Dr. Melsheimer's home. We owe to this circumstance probably the friendship and the zeal for entomological studies of both. To help Dr. Melsheimer in describing the new species of *Coleoptera* for the forthcoming catalogue, Rev. D. Ziegler published in *Proc. Acad. Sc. Philad.*, 1844, vol. ii., p. 43-47, his only entomological paper, containing thirty-six new species. His scientific correspondence, which was considerable, both American and foreign, cannot be found. His library contained some excellent works, all very much used. When sixty years old he sold, together with Dr. Melsheimer, his collection to Prof. L. Agassiz. The collection was packed up and forwarded to Cambridge by Mr. Ph. R. Uhler, from Baltimore. The contents of the collection are given in my Melsheimer paper, p. 196. Rev. J. G. Morris writes: "I remember hearing Ziegler say that he sold his specimens of Hymenoptera to a Swiss naturalist who has written upon that order, perhaps to DeSausure." This may explain the fact that the collection contained only sixty species of N. Amer. Hymenoptera and fourteen from Europe. Rev. D. Ziegler died May 23, 1876, in York, Pa., seventy-one years, ten months, twelve days old.

"There was nothing whatever eventful in his life, and besides his few entomological contributions, he was nothing more than a plain, plodding, honest country parson."—(J. G. Morris.)

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## OBITUARY.

We regret to announce the death of one of our esteemed members, Mr. Wm. Murray, of Hamilton, Ontario, who passed away after a protracted illness early in March, 1885. He was an enthusiastic and industrious collector of both Lepidoptera and Coleoptera, and paid special attention to the Sphingidae and the Catocalas. His collection, embracing a large number of specimens, has been bequeathed to the Entomological Society of Ontario, and is now safely deposited in the rooms of the Society.

## ENTOMOLOGICAL CLUB OF THE A. A. A. S.

The meetings of the club at Ann Arbor were held daily from the 25th to the 28th of August, both dates inclusive, and were very successful. The following among others were present and in constant attendance:—J. A. Lintner, C. V. Riley, Herbert Osborne, John B. Smith, D. S. Kellicott, O. S. Westcott, L. M. Underwood, A. J. Cook, E. A. Swarz, Henry G. Hubbard, S. H. Peabody, Clarence M. Weed, Miss M. E. Murtfeldt.

In the absence of Dr. Morris, Prof. J. A. Lintner presided. Officers for the ensuing year are: President, Prof. J. A. Lintner, of Albany; Vice-President, Mr. E. A. Swarz, of Washington; Secretary, Mr. John B. Smith, of Brooklyn.

Aug. 25.—The following papers were read: A Biographical Sketch of William LeBaron, late State Entomologist of Illinois; Notes on some Structural Characters of the Lepidoptera, By John B. Smith. The Family Position of *Euphanessa mendica*, by Geo. D. Hulst.

Aug. 26.—Notes on *Harmonia pini*, by D. S. Kellicott; On the Preparatory Stages of an Undetermined Cossus, by D. S. Kellicott; On the Principal Injurious Insects of the Year, by C. V. Riley. Messrs. Kellicott, Underwood and Osborn spoke on the same subject.

Aug. 27.—Messrs. Cook, Osborn, Smith and Riley continued the discussion of injurious insects of the year. Messrs. Lintner, Riley and Westcott discussed the ease and difficulty of raising certain larvæ. Mr. Osborn gave some notes on the habitat of a Chironomous; Mr. Cook gave some notes on the functions of the secretion of Bark Lice (*Leucanium tilia*); also some notes on the Choke Cherry Tortricid, *Cacacia cerasivorana*. Mr. Westcott gave some notes on the abundance of certain Coleoptera.

Aug. 28.—Random Notes on Mallophaga, by Herbert Osborn; Larval Longevity of a Species of Coleophora; Extract from a letter of W. H. Edwards, on some food plants of *P. ajax*; On a Peculiar Structure of the *Cosmosoma omphale*, by E. A. Schwarz. How shall we Create and Foster an Interest in the Study of Entomology? by John B. Smith. All the gentlemen present participated in this discussion, which was of great interest.

The following committee of arrangements for the next meeting was appointed: Chairman J. A. Lintner, and Messrs. John B. Smith and C. V. Riley. Adjournment to meet at call of the President at the next meeting of the Association.

## BOOK NOTICES.

Report of the Dominion Entomologist for 1884.—Department of Agriculture, Ottawa.

A long felt want has at last been supplied by the appointment of a Dominion Entomologist, and a well qualified expert selected for the work, Mr. James Fletcher, whose preliminary report is before us. His appointment was made so late in the season that he has been unable to do more than furnish a brief report, in which reference is made to the organization of the department under his charge and the measures taken to interest all those engaged in agriculture and horticulture in the work. Following this is a report on the quality of the Paris green found in the market, with results of the analysis of six samples; also reports on insects injuring grain crops, hay and clover, peas, root crops, fruits and forest trees; altogether a useful review of the chief injuries caused by insects to these several crops during 1884. We sincerely congratulate Mr. Fletcher on the good work thus far done, and earnestly hope that he may be able to carry to a successful issue the plans laid out for the present year.

Eighth Report of Observations on Injurious Insects and Common Farm Pests, with Methods of Prevention and Remedy, by Eleanor A. Ormerod. Dunster Lodge, near Isleworth, England; 8vo., pp. 122, with 39 cuts. Published by Simpkin, Marshall & Co., Stationers' Hall Court, London, England.

We are much indebted to the talented authoress for a copy of this valuable report, which is in no respect behind its predecessors. In the preface reference is made to the relations of birds to insects, wherein the sparrow is condemned very strongly. Its habit of driving away other and more useful birds, together with its grain-feeding propensities, are fully recognized in England as well as in this country, and fairly entitle it to be regarded as an enemy rather than a friend. More extended reference is made to this subject in a chapter headed "Birds, Depredations of Sparrows." The insects which have proved injurious to the following fruits, vegetables, trees, etc., during the past year, together with the best methods of preventing their ravages, are also treated of in the following order: Apple, beans, cabbage, carrots, corn and grass, gooseberry, hop, mangold, oak, onions, parsley, pine, potatoes, raspberry, turnip and willow. The report also contains chapters on marsh snails and the ox-bet-fly. Miss Ormerod has succeeded in awakening much interest in England on the subject of injurious insects, and by her careful observations and experiments has conferred lasting benefits on the agricultural community.

General Truths in Applied Entomology, by C. V. Riley, 8vo., pp. 7.

An essay read before the Georgia State Agricultural Society, relating chiefly to insecticides and the best methods of applying them.

Recent Advances in Economic Entomology, by C. V. Riley; 8vo., pp. 3.

A communication made to the Philosophical Society of Washington in reference to insecticides.

U. S. Department of Agriculture, Division of Entomology; Bulletin No. 4, 8vo., pp. 102.

This useful publication contains a report on Cranberry and Hop Insects, by John B. Smith; observations on the Rocky Mountain Locust, by Lawrence Bruner; on Insects

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**Revised Catalogue of the Diurnal Lepidoptera of America, North of Mexico, by Wm. H. Edwards, 8vo., pp. 95. From Transactions of the American Entomological Society, 1885.**

This revised catalogue of American butterflies was greatly needed. Since Mr. Edwards published his first catalogue in 1877, much new material has accumulated, more than a hundred new species have been described, while a vast amount of information has been published on the preparatory stages and habits of these insects. Much of this has been communicated by the author of the catalogue himself, who has brought an amount of enthusiasm to bear on this interesting field of research exceeding that of any of his predecessors or co-labourers, while his full and accurate descriptions have been everywhere appreciated. Other excellent workers have also added to our stock of knowledge in this department, to all of which ready reference is had by the use of this catalogue. The new edition gives fuller references with dates, whereas the former catalogue gave no date. Many corrections are made in the synonymy, the result of a careful scrutiny by the author of every species in the entire list; the localities are also given with greater fullness. A large proportion of the additions to the list of new species are to be found in the Hesperidae, to which fifty-six have been added. Many additions have also been made to Melitaea, Thecla and Argynnis. A new and excellent feature is a copious index of genera and species, which will be much appreciated by all who have occasion to consult its pages. In this catalogue the author has given us the full benefit of his long experience and careful study, and has produced a work which will not only commend itself, but will be indispensable to all who are engaged in the study of American butterflies.

**Contributions to the Descriptive and Systematic Coleopterology of North America, Part II., by Thos. L. Casey, U. S. A.; 1ge. 8vo., pp. 137.**

Contains very full and careful descriptions of ninety-three new species of Coleoptera, and many new genera; also systematic revisions of several genera as represented in the United States. A very useful and valuable contribution to this department of Entomology.

**On the North American Asilidae, Parts I. and II., by S. W. Williston, M. D.; 1ge. 8vo., pp. 58. From the transactions of the Amer. Ent. Soc., xi., December, 1883, and xii., Jan., 1885.**

These excellent papers contain descriptions of forty-three new species, together with fresh descriptions of many of the older forms. Part I. contains a very complete table of genera, with two plates illustrating the parts of the insect used in classification. Part II. contains convenient tables of the species belonging to the following genera: Laphria, Mallophora, Promachus, Erax and Proctacanthus, in which the chief distinguishing features of the species are briefly given.

**Notes on the Systematic Position of Some North American Lepidoptera, by John B. Smith; 8vo., pp. 8, with one plate containing twenty-three figures, illustrating the structure of Zygaena, Eudryas, Alypia, Stiria, Pyromorpha, Conosoma and Ctenucha.**

The Standard Natural History—Article, Heterocera, by C. H. Fernald.

We are indebted to the author for a copy of this interesting popular article on Moths, covering forty-five pages small quarto, illustrated with thirty-four figures and one plate of silkworm moths.

Elephant Pipes in the Museum of the Academy of Natural Sciences, Davenport, Iowa, by Charles E. Putnam; 8vo., pp. 40, with one figure.

### THE OAK PRUNER.

KLAPHIDION VILLOSUM, FABR.

By Frederick Clarkson, New York City.

There is in the study of Entomology a fascination and delight that captivates the imagination, and renders the enthusiast liable to construct theories based upon such slender foundations that they fail to reach the dignity of assured facts. This, I think, may be said of much that has been written concerning the habits of this beetle. The record which I have thought proper to make relates to veritable facts, but whether in the particular instance referred to they are to be regarded as extraordinary and not of common occurrence, may be a problem yet to be solved. I trust that in offering this paper I may not be thought presumptuous in differing with so distinguished Entomologists as Drs. Harris and Fitch, yet as my observations do not bear out the conclusions which they have reached, and apprehending that the best interests of the science are served by that record or enquiry which relates to the discovery of facts, I make no apology to these fathers in the science for transcribing in relation to this subject views somewhat dissimilar to theirs.

Dr. Harris says that if a burrow be split open in winter, it will be found to contain larva, which in the spring assumes the pupa form, and in June or July is changed into a beetle. He is in accord with Dr. Fitch concerning the periods of transformation, and holds similar views with him as to the habit of pruning. Dr. Fitch, I think, unduly exalts the instincts of these beetles as illustrated in their larval habit of pruning the twigs and branches of the oak, contending, as he does, that the twig or branch is eaten away by the young larva for a small space, and left supported only by the bark, that the autumn winds may fell it to the ground, and that the environment of its new condition is necessary to the transformation of the included larva. This is substantially what each writer has to say upon the subject, though Dr. Fitch's report is very lengthened and rather extravagant in imaginative conclusions.

These oak pruners were very abundant in Columbia County, this State, in the season of 1878. The September winds brought showers of twigs and branches to the ground. I examined many of them, and found each to contain the larva, nearly full grown, in tunnels measuring from ten to fifteen inches long. I gathered 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 condition, thermometrically, of the temperature without, until the early part of November, when I opened them for the purposes 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—how much less I know not—and without the surroundings as narrated by Drs. Harris and Fitch. I am therefore inclined to the opinion, born of these facts, that the transformation, barring strong winds, is as likely to occur in the tree as on the ground, and that the branch is eaten away by the young larva

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not for the extraordinary reasons as cited, but for the more probable one, to prevent the flow of sap, which, if not checked, may render the wood fibre unwholesome to the larva, or possibly affect injuriously the later condition of pupa and imago. It would appear, moreover, that the beetle is developed in the autumn, and remains within the burrow during the winter.

## SWARMING OF THE ARCHIPPUS BUTTERFLY.

BY EARNEST D. WINTLE, MONTREAL.

While out on an ornithological ramble on Cote des Neiges Mountain, near Montreal, on the 22nd of August last, I observed a large number of *Danaus archippus* congregated together; numbers were clustered on dead branches of trees and underbrush, also on ferns. I could easily have caught a hundred without moving more than ten paces. I don't remember having seen this species so abundant here for several years. Last year *Pyra-meis cardui* appeared to me to be the most plentiful butterfly here, during August and September. I also noticed a large number of this latter species on the marshes of Lake St. Peter, about sixty miles down from Montreal. This was in the early part of September, last year. If you consider the above notes interesting enough to publish, I should like to know the cause of the above mentioned assemblage of *archippus*. The weather was showery in the morning, and sunshiny in the afternoon, with a stiff breeze blowing from the south.

## HUMBLE BEES.

BY THE REV. C. J. S. BETHUNE, M.A., PORT HOPE, ONT.

Robbing bees' nests has, no doubt, always been a favourite sport with boys in the country. We can well remember how we used to look out for them towards the end of summer, around stumps and under logs in the pasture fields, and how we used to watch where they flew, and spy out where they had their nests between the weather-boarding and lining of the barns, among piles of stones, and in all sorts of nooks and corners. Great used to be our delight when on some fine September afternoon one of us boys would come running breathlessly to the others, shouting out that he had found "such a jolly big bumble-bees' nest," and that one of them had given him such a chase! Away we would all scamper; arming ourselves with twigs of cedar and broad bats made of shingle, till we came near the scene of action; then we would cautiously advance, give the nest a little kick, and put our ears as close as we dared to listen to the buzzing inside, knocking down with our bats any bee that came out to see what the matter was. A few more kicks, or pokes with a stick, would forcibly change the note of the bees to an angry *bizz-z*, and put the whole colony in commotion, and then would begin the tug of war—furious assaults being made on our part and desperate rallies on the part of the bees; sometimes the invaders would be so fiercely repulsed as to be forced to take to their heels, stung perhaps under the eye or about the neck and face by a "forlorn hope" from the besieged. But soon the contest would be renewed, and the pigmy defenders of their home would suffer for their gallantry with the loss of their lives, and the unequal conflict would end in our digging out the sweet spoils from the inmost recesses of the nest. All we could obtain would be a few waxen cells or bags of inferior honey; but after all it was the excitement of the contest and not the spoils of victory that chiefly attracted us. The sport was, doubtless, a cruel and wanton one; but when will boys who rob the nests of gentle birds, impale live minnows on their fish-hooks, or fire their guns at innocent squirrels, think twice about robbing bees' nests? What is sport to them is too often, alas! death to their victims! But happily these amusements generally proceed from sheer joyous animal

spirits, and not from any wanton love of cruelty, and the restless play-loving boy grows up to be a kind and tender-hearted man.

Thinking that some of our boy-readers, at any rate, if not their elders, would like to know something more about the habits and lives of the humble or "bumble" bees (as they are popularly called in the country), whose nests they rob, we shall attempt to give some little account of them.

The name "humble" bee, usually applied to these insects in books, has no reference to any latent grace of humility supposed to exist in them, but is derived—like the more popular term "Bumble" bee—from the loud humming noise they make when flying, and which is especially noticeable when they accidentally come into a room and are unable to find their way out again. The same phonetic origin may be observed in the names employed in other languages, for instance *hummel* in German, *bourdon* in French, and the scientific name *bombus*, derived from the Greek word for the buzzing noise of bees. In Scotland also, and in some parts of the United States, large species of this genus are called *bumblebees*. As we may infer from the variety of names, these insects are widely distributed throughout the world, being found in all temperate regions, except Australasia, and even in far northern regions within the Arctic circle. Our friend, W. Bowles, relates in his paper (Report of the Ent. Soc. of Ontario, 1879), that while *thirteen* species of this genus are found in Arctic America, only seven are found in Canada and eight in the New England States.

Early in the spring, as soon as the willow catkins are in bloom, the big, handsome, yellow-uniformed queen-bees, who alone have lived through the winter, may be seen buzzing about, searching everywhere for a suitable place for their nests. They fly about here and there close to the ground, alighting every now and then, and creeping into the grass and weeds, and then off again with a busy, good-humoured hum, taking alarm very easily and flying away on the least appearance of danger. The object of all this searching is usually the deserted winter-quarters of a field or barn-house, where the bee finds ready for her purposes a hidden burrow and a chamber filled with a nice soft bundle of dry hay or grass. Generally these nests are well concealed under ground, or beneath stones or rubbish, but sometimes in meadows they are quite on the surface with no protection from the foot of the passer by or the mower's sharp scythe. When at length the queen-bee has determined upon her future abode, and has provided a suitable passage way to it from the outer air, she collects from the early spring-flowers a small amount of pollen mixed with honey, and deposits in it from half a dozen to a dozen eggs; then she gathers more pollen and honey, and lays the eggs for a second brood, and so on till the colony is complete. The eggs, according to the observations of Professor Putnam\* are "hid in contact with each other, in the cavity of the mass of pollen, with a part of which they are slightly covered. They are very soon developed; in fact the lines are nowhere distinctly drawn between the egg and the larva, the larva and the pupa, and again between the latter and the imago, a perfect series, shewing this gradual transformation of the young to the imago, can be found in almost every nest.

"As soon as the larvæ are capable of motion and commence feeding, they eat the pollen by which they are surrounded, and gradually separating, push their way in various directions. Eating as they move and increasing in size quite rapidly, they soon make large cavities in the pollen mass. When they have attained their full size, they spin a silken wall about them, which is strengthened by the old bee (after the first brood has matured) covering it with a thin layer of wax, which soon becomes hard and tough, and thus the cells are formed. The larvæ now gradually attain the pupa stage, and remain inactive until their full development. They then cut their way out and are ready to assume their several duties as workers, small females, males or queens, according to their individual formation.

"It is apparent that the irregular disposition of the cells is due to their being constructed so peculiarly by the larvæ. After the first brood, composed of workers, has come forth, the queen-bee devotes her time principally to her duties at home, the workers

\*"Notes on the habits of some species of Humble Bees." By F. W. Putnam, in the proceedings of the Essex Institute, Salem, Mass., vol. iv., Oct. 1864.

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supplying the colony with honey and pollen. As the queen continues to be prolific, more workers are added, and the nest is gradually enlarged.

The government of these colonies seems to be somewhat different from that observed in the hives of the honey-bees. The latter have but one queen, the mother of the whole swarm, while their cousins, the humble-bees, have many queens, or large females, in their nests at one time, after the first broods have become developed. There are also a number of small females, which produce only male eggs and do not survive the winter. The large females, or queens, alone hibernate, and become the founders of new colonies the following year, in the manner described above; their eggs produce neuters or workers first, and afterwards apparently females of both kinds, or males or drones. The number of individuals in a nest varies very much with the species, and is said to be fewer in those located above ground than in the subterranean colonies. We have found less than thirty individuals in a nest under some of the boards in a fence corner, but that was in October, when many may have perished from the assaults of various enemies. In the nest of an English species, *bombus terrestris*, which is situated a foot or more beneath the surface of the earth, there have been found 107 males, 56 females and 180 workers.

"About the middle of summer"—to resume our quotation from Professor Putnam—"eggs are deposited which produce both small females and males. All eggs laid after the last of July produce the large females or queens, and the males being still in the nests, it is supposed that the queens are impregnated at this time, as on the approach of cold weather, all, except the queens, die. It is desirable to ascertain whether the queens remain torpid during cold weather, and what use is made of the pollen and honey stored during the end of summer and in autumn; it may perhaps be food for the queens during mild weather in early spring before any plants are in blossom. Very little wax is made by the humble bees, as it is only used for covering the cocoons of the larvæ, for thinly lining the nest or the inside, for strengthening the old cells which are used for honey pots, and occasionally covering these pots, and for propping up the cells."

One important use of the wax made by these bees, especially those that make their nests in the meadows without much protection from the weather, is the lining of the roof of the nest. Between the cells and the outer covering of fine grass or hay, a coating of wax is attached to the inside of the protecting mass, and forms a waterproof envelope for the store within. How this wax is produced is thus described by Dr. McCook: "Tenants of an old Farm," p. 176—a most charming book on insects. "The bee secretes the wax from its own body. On the under side of the abdomen are six little flaps, not unlike pockets, the covers of which can be easily raised with a pin. Under these flaps is secreted the wax, which is produced in tiny seals or flaps, and may be seen projecting from the flaps like little half-moon-shaped white lines. A scale of wax is drawn out from the abdominal ring by pincers fixed at the joint of one of the hind pair of legs, and is carried to the mouth. It is there worked up by the mandibles and tongue, and undergoes some important change. Plenty of food, quiet and warmth are necessary for the production of wax, and as it is secreted very slowly, it is extremely valuable and used by the bees with great economy. How wax is formed within the body of the bee we cannot explain, any more than we can tell how the liquid silk is produced within the spider's silk glands. The author of Nature has endowed these creatures with such gifts, and the power to use them—we go no further. But it is a wonderful substance, soft enough, when warm, to be kneaded and spread like mortar, and hard enough when cool to bear the weight of brood and honey. Moreover, it is of a texture so close that honey cannot soak through the delicate walls of the cells, which are perfect, natural honey-pots.

In order to gather honey, the bee has at the end of its face a long, hair clad proboscis or tongue which it inserts into the recesses of flowers, brushes out the nectar, passes the laden tongue, through its jaws, scrapes off the sweet liquid and swallows it. Just within the abdomen the œsophagus expands into a little sac called the crop or honey-bag, and into this the nectar is passed. If the bee wants to eat, it opens a minute valve which divides the crop from the stomach which is just beyond it, and lets out enough to satisfy its hunger. As long as the valve is closed the nectar accumulates, and when the crop is filled the bee flies home and regurgitates the collected sweets into one of the honey-cells.

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Besides honey, the bees bring back to their nests from the flowers quantities of pollen—the coloured dust from the stamens of the blossoms. Everyone has probably noticed the balls of yellow, brown or whitish pollen adhering to the bees' legs, as they leave the flowers. These balls are carried in the basket provided by nature for the purpose. The skin or middle portion of the hind legs is flat and smooth, of a triangular shape, and slightly hollowed on the outer side. This horn-like substance forms the bottom of the basket. Around the edges of this plate are placed rows of strong, thickly-set, long bristles which curve inward. These are the walls of the basket and complete the structure. The pollen is collected gradually with the mandibles, from which the short fore-legs gather it. Thence it is passed backward to the middle-legs by a multiplied series of scrapings and twistings, and from them to the hind legs, where it is scraped and patted into the baskets. It is secured from falling out by the walls of bristles whose elasticity will even allow the load to be heaped beyond their points without letting it fall. When the busy harvester has gathered as much as her basket will conveniently hold, she flies away home and empties her load by a reversal of the process which filled it. In this task, however, she is often aided by her fellow-workers.

Like all other insects,—indeed, one may say, like all other living creatures on this earth, the humble-bee is infested by various parasitic enemies that prey upon it at various stages of its existence. Among insects generally, there are certain species which prey upon the eggs of the victim; others, and this is the most common mode of parasitism, attack the insect in its larval state; others in the pupa state, and still others when it attains to its winged form. Of these parasites the various kinds of Ichneumon flies are much the most common, and do most efficiently the work of keeping in check the undue multiplication of the larger insects that they attack. Next to them come the different species of Tachina, which outwardly resemble very closely the common house-fly. These, as well as the Ichneumons, live in the bodies of their hosts when in the caterpillar or larval state; they consume the fatty parts and finish their transformations when their exhausted victim is about to die. An insect, very similar to the Tachina, produces the disease well-known to bee-keepers called "foul brood," and which is very similar to the typhus fever of man. This tiny fly named *Phora*, enters the bee-hive, and gaining access to a cell, bores with its ovipositor through the skin of a bee larva, and lays its egg within the body of the grub. Very quickly the egg hatches and in a few hours the fly-maggot begins to eat the fatty tissues of its victim; in a day or two the young bee, emaciated by the attacks of its ravenous parasite, dies, and its decaying body fills the bottom of the cell with a corrupt mass called foul-brood. This creates a miasma which poisons the contiguous cells, and then the disease spreads rapidly through the whole hive, unless promptly checked by removing the cause and thoroughly cleansing the hive. Another enemy of the honey-bee is a wingless louse which is sometimes found in hundreds on the body of a bee. These common parasites of the honey bee are mentioned, because in all probability they attack the native wild bees as well, though little is as yet known about their life and troubles under ground.

Among the parasites of the humble bee that are well-known, may be mentioned the larvæ of the beautiful dark blue oil beetle (*Melœ angusticollis*, Say.) During April and May, when the willows are in blossom, these little grubs may be found creeping briskly over the hairy bodies of the bees, as they buzz about the catkins. They penetrate between the segments of the body, and suck the juices of their victim, finally completing their strange transformations in the cells of the comb to which the unconscious bee has brought them. When in the nest they are said to devour eggs and bee-bread indiscriminately.

Another strange enemy of the humble bee is the *Stylops*, a curious insect somewhat allied to the oil beetle. The wingless female spends its whole life within the body of a bee, feeding upon and weakening, but not actually killing its host. The young, which apparently are born alive and not produced from eggs, creep out from the mother to the surface of the bee's body, and are thus carried into the nest where they enter the bodies of the grubs in the cells and feed upon their fatty parts. The males, when full grown, have wings and can fly away in search of mates, while the females continue imprisoned.

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Among the insects which in some way or other prey upon the humble bee may be mentioned the closely allied genus *Apathus*, the members of which outwardly look very like the true humble-bee, but differ from them in possessing no pollen-collecting apparatus, and in having no worker or neuter forms. They live on apparently most friendly terms with their good-natured hosts, but what part they play in the economy of the community, beyond living with them as visitors, is not known.

Another insect, though only a two-winged fly (*Vollucella*), also very closely resembles a humble-bee in appearance; it frequents the bees' nests and in its larval state devours the brood and stores. Various beetles are frequently found in the nests, and a tiny moth, nearly allied to the common clothes-moth, infests the abode and bears some part in the general raid upon the lives and property of the poor humble bees.

These numerous though tiny enemies would seem to be enough to prevent any undue increase of numbers among our friends, but there are still others of a much larger growth. Not to mention again the ordinary boy who does his full share in the work of decimating the numbers of the humble-bees, they are vigorously preyed upon at night by the unsavoury skunk. This animal, which by the way deserves commendation for destroying myriads of "June beetles," and other noxious insects, hunts for the nests of the bees during its nocturnal rambles, and when found tears them open and makes a sweet meal upon the larvæ and other contents of the nest.

A still more serious enemy is the field-mouse; possibly it is actuated by the feeling of revenge, and wishes to make reprisals upon the bees for taking possession of its abandoned nests, by devouring the honey-comb. The part which these four-legged vermin play in the economy of nature in connection with the bees is thus curiously described by the great Naturalist Darwin, in his "Origin of Species."

"We may infer," he says, "as highly probable that were the whole genus of humble-bees to become extinct or very rare in England, the heart's ease and red clover (which they fertilize by carrying pollen from flower to flower), would become very rare or wholly disappear. The number of humble-bees in any district depends in a great degree on the number of field-mice which destroy their combs and nests; and Colonel Newman, who has long attended to the habits of humble-bees, believes that more than two-thirds of them are thus destroyed all over England. Now the number of mice is largely dependent, as every one knows, on the number of cats. Colonel Newman says that near villages and small towns he has found the nests of humble-bees more numerous than elsewhere—a fact which he attributes to the number of cats that destroy the mice. Hence it is quite credible that the presence of a feline animal in large numbers in a district might determine, through the intervention first of mice, and then of bees, the frequency of certain flowers in a district."

So important is this work of pollen carrying by insects for the due fertilization of plants, that repeated efforts have been made to naturalize the humble-bee in Australia. It has been found that the red clover fails to produce its seeds in that country owing to the entire absence of humble-bees, which alone seem able to penetrate its long corolla and carry the pollen from one blossom to another. The proboscis of the honey-bee is too short to effect this object, but it is easily accomplished by the long appendage of the humble-bee. The specimens imported by the Australians failed to survive the long voyage, until quite recently when, we understand, some larvæ were taken over and reached their destination alive. It will be a matter of much interest to learn whether successful colonies can be reared in that continent which alone has thus far failed to be a home for the humble-bee.

## BUTTERFLIES.

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

What beauty and animation do the butterflies impart to the summer landscape? What pleasant memories do they recall! Were they suddenly exterminated what a loss would be felt! And yet, how many people having eyes see them not—allow them to

pass as things in a dream—satisfied with their beauty, and incurious. The Rev. J. G. Wood observes with reference to country people and insect life,—“It is a very singular fact that those who, living so much in the open field, would be supposed to have correct knowledge of natural phenomena, are really profoundly ignorant of facts that pass daily before their eyes.” His words, when I read them, sent my thoughts back to my early years—to my school-boy life in the country, when, at any rate, every species of bird and its egg, that were there to be found, were familiar to me; and I set myself to consider what kind of insects really attracted my attention then. I was amazed at their paucity. I knew nothing, in those days, of Entomology as a science—I was in the position of an ordinary observer having a general love for nature. But when an insect did make an impression on my mind that impression was a deep one; and it is astonishing to me now how vividly I can recall the companions, the scenes, the circumstances connected with the creatures’ appearance to me. Such early impressions are “as nails fastened by the masters of assemblies” in a sure place, and many things are suspended from them. Wordsworth, in his address to a butterfly, has expressed his experience of the strange power that an early attraction has of securing an association of ideas in the mind. He says,—

“Stay near me—do not take thy flight!  
A little longer stay in sight!  
Much converse do I find in thee,  
Historian of my infancy!  
Float near me: do not yet depart!  
Dead times revive in thee:  
Thou bring’st, gay creature as thou art!  
A solemn image to my heart,  
My father’s family!

Oh! pleasant, pleasant were the days,  
The time, when in our childish plays,  
My sister Emmeline and I  
Together chased the butterfly!  
A very hunter did I rush  
Upon the prey:—with leaps and springs  
I followed on from brake to bush:  
But she, God love her! fear’d to brush  
The dust from off its wings.”

“How well one remembers the ‘Long time ago’ with which so trivial a thing as the capture of an insect, even though of no great rarity, is associated,” says the Rev. F. O. Morris (*British Butterflies*, p. 89.) As early insect acquaintances I can only recall the *Common Blue*, the *Small Copper*, the *Speckled Wood*, the *Peacock Butterfly*, the *Six Spot Burnet Moth*, the *Maggie Moth*, the *Tiger Moth*, the *Stag Beetle*, the *Devil’s Coach-horse*, the *Cock chafer*, the *Glow-worm*. Four butterflies, three moths, and four beetles—not a long list. And I suppose there are thousands who individually could not recall a greater number, and who yet would acknowledge the force of Kate Kavanagh’s words in “Beatrice”—“We all have some secret communion with nature—some fine and subtle link by which we are bound to the great mother.” They have needed a friend to take them by the hand, and to introduce them to the charming world of insects.

Even the poets, who sing of all lovely things, very seldom speak of the butterfly: the bee is a greater favourite with them. In the works of that gentle priestess of nature, Jean Ingelow, I can only find three allusions to our butterfly friends. In that delightful poem “Divided,” she says:—

“Flusheth the rise with her purple favour,  
Gloweth the cleft with her golden ring,  
’Twixt the two brown butterflies waver,  
Lightly settle and sleepily swing.”

In “Scholar and Carpenter,”

“And I admired and took my part  
With crowds of happy things the while:  
With open velvet butterflies  
That swung, and spread their peacock eyes,  
As if they cared no more to rise  
From off their beds of chamomile.”

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St. Henri, Quebe  
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*en bas*. It is sai  
never met with  
have for several



## And in "A Dead Year,"

"Let me smell the wild white rose,  
Smell the wood-bine and the May;  
Mark, upon a sunny day,  
Sated, from their blossoms rise  
Honey-bees and butterflies."

The number of individuals of some species, like the multitude of representatives of some kinds of wild flowers, seems to forbid the investigation that rarity would invite. Things that are seen continually are passed by unheeded; and many so called familiar things, are in reality strange to us. "The works of the Lord are great," but, it is added, "sought out by all them that have pleasure therein." His treasures are everywhere abundant; but it is "he who seeketh" that "findeth."

The butterflies here, as elsewhere, form but a small portion of the Lepidoptera. I have in my collection representatives of fifty-four species taken in the Province of Quebec. I have heard of the capture therein of specimens of six other kinds. So we may set down the number of known species of Quebec butterflies at not less than sixty.

It is charming in early June, when the maples are in their fresh green, to see *Papilio Turnus* flit through the sunny glades, like a fairy, or a hamadryad. So also is it to watch *Papilio Asterias*, as she sweeps by, sombre in dress, and graceful in motion as a Spanish belle. Where the wild gooseberry is in blossom, or over their food plant, *Cornus*, sporting groups may be seen of the delicate blue butterfly *Lycæna Lucia*, of the variety that Mr. W. H. Edwards has named *Marginata*. The Comyntas Blue is local. I have taken it on Mount Royal early in May, but have never seen it further east. Other local species taken at Montreal are *Thecla Mopsus* (July 14th), *Neonympha Eurytris* (latter part of June), *Eudamus Tityrus* (June and July), *Debis Portlandia* (August). The last is very rare. Mr. P. H. Gosse tells of the capture of it (under the name of *Hipparchia Andromacha*) at Compton about 90 miles east from Montreal. I have never seen the living insect. I am indebted to Mr. Caulfield of Montreal for the specimen I possess. I met with *N. Eurytris* in the Eastern Townships for the first time in 1882. *Chrysophanus Hylbus* showed itself in our meadows in 1879. It has since become plentiful. *Feniseca Tarquinius* fell into my hands early in September, 1881. I was driving along a road which led by an alder swamp in the township of Stanbridge, when my vehicle brushed the foliage, and disturbed an insect. I said to a friend who was riding with me "That insect flies like a Vapourer Moth, but it is of a different shade, I will get out and see what it is." With some difficulty, owing to its indistinct colouring and its uncertain flight, I captured the specimen, and found it to be one of the species new to me. A few days afterwards I returned, and spent an afternoon in the swamp, and met with several individuals of the kind, which in every case were resting on the upper side of the leaf of the alder (*Alnus incana*), or on its stem. I found no hawthorns near the spot, though I searched carefully for them, so I cannot help thinking that the old appellation for the insect, *P. Cratægi*, was a misnomer. The insect has been taken in an alder swamp also by Mr. H. H. Lyman, of Montreal. On July 24th 1882, I again captured *F. Tarquinius*. It was in a photographer's "saloon" on the Main Street, Cowansville, P. Que. The Saloon, a Japanese sort of arrangement of movable panels, had stood on the Exhibition Ground, Montreal, until the October preceding. It was then moved to the Townships, and packed away for several months. As the insect was beautifully fresh, I have no doubt that it was accidentally imported in the chrysalis state. On August 30th, 1885, I again saw *F. Tarquinius* amongst alders on the Island of Orleans.

*Ancyloxypha Marginatus* I have taken in September in a bottom land by the Ymaska river in the township of Shefford, amongst the wild grasses that are found in such localities. *Pamphila Egremet*, *Pholisora Catullus* and *Pyrgus Centaureæ* I have met with among the hills bordering upon the State of Vermont. *Melitea Harrisii* in a swamp at St. Henri, Quebec. *A. Atlantis*, *C. Eurytheme*, and *G. Faxnus* among the woods and meadows of the County of Missisquoi. *Pamphila Manitoba* may be taken at Riviere-du-Loup *en bas*. It is said that *Grapta interrogationis* has been captured near Montreal. I have never met with it. *Chionobas jutta* was formerly taken near Quebec. For it, too, I have for several seasons searched in vain. Mr. J. G. Jack, of Chateaugay Basin, has

recorded the capture, at that place, of *Papilio Cresphontes* and *Euptoieta Claudia* (see Can. Ent. v. xiv., p. 219). Mr. Fletcher has found *Thecla Nippon* in abundance in the neighbourhood of Ottawa. His interesting account of the insect has appeared in the Society's publications.

Of our common butterflies, *Colias Philodice* is one of the most plentiful. It is seen with wings erect on moist spots in the country lanes, in sedate assemblies that have often been suggestive of beds of crocuses. *Vanessa Antiopa* is another insect that is everywhere abundant with us; and it is as beautiful as it is common. In England, where it is extremely rare, it is called the "Camberwell Beauty," its capture at Camberwell having been recorded. I once saw the insect in Lord Scarborough's wood, in Langton Carr, Lincolnshire. It was in October, when insects were few. I was standing motionless when a stately insect came gliding over the trees and settled on a young oak, on which the sunlight was playing three yards in front of me. It just spread its wings, and fairly displayed its beauties, and then sailed away and I saw it no more. Besides *V. Antiopa*, the butterflies common to both countries are *Pyrameis Atalanta* (the Red Admiral), *P. Cardui* (the Painted Lady), and *Pieris Rapæ* (the small cabbage butterfly). A single specimen of *Argynnis Aphrodite* (the Venus Fritillary) was taken in 1833, in Upton Wood, near Leamington, Warwickshire, by James Walhouse, Esq., of that place. One specimen also of *Pyrameis Huntera* (the scarce Painted Lady), was captured by Capt. Blomer, at Withybush, near Haverfordwest, S. Wales, in 1828 (Morris' Butterflies, pp. 76 and 113). *P. Huntera* is generally scarce on this side of the Atlantic, but in 1879-80 numbers of the species could be seen. *P. Cardui* in England, it is said, appears abundantly about every seventh year.

The most beautiful of our Quebec butterflies is, I think, the Banded Purple (*Limenitis Arthemis*). It has a velvety richness that is very attractive. It is met with abundantly in the mountain roads of Brome and Shefford, in June and July. On such roads, too, at times *Grapta J. Album* is plentiful. This insect is one that is most difficult to catch. It rests with closed wings, and the dull hues of the exposed under sides closely resemble those of the fencing on which the insect usually settles. As an intruder upon its haunts approaches it, it dashes away with a speed that sets pursuit at defiance. The specimens of this insect that I possess were found hibernating in an unused room in the upper story of the Missisquoi High School. *Melitæa Phaëton* (the Baltimore Fritillary) seems to delight in swampy hollows among the hills, and *Neonympha Boisduvallü* (Boisduval's butterfly) in mountain meadows.

In autumn, when the roads are lined with Golden Rod (*Solidago Canadensis*) in full blossom, flocks of Fritillaries of the species *Arthemis*, *Myrina* and *Bellona*, rise as the wayfarer approaches. Here and there an insect may be seen fixed helpless on the plant. Examination discloses that it is in the clutches of a lurking foe, of a curiously shaped bug (*Phymata erosa*), that is sucking its life away. This bug lies hid amongst the blossoms which it closely resembles in colour, and when a butterfly alights above it, seizes the unwary insect with its powerful front legs formed for grasping, drives its beak into the body of its victim, and holds it till its appetite is sated.

Insects may be lost to us through improvements. The Great Copper butterfly (*Chrysophanus dispar*) was lost to England through the draining of Whittlesea Mere. The cleaning out and draining of a bottom land in Brome banished *Melitæa Phaëton* from that particular spot. On the other hand, improvements may fit the country for the abode of new species from the South. The introduction of the cut-leaved ash has brought *Papilio Cresphontes* to Quebec Province. *C. Hyllus*, as we have seen, has but lately found its way hither. To the Niagara district southern forms, such as *Papilio Marcellus*, *P. Ajax*, *P. Philenor*, etc., etc., etc., wafted northward by the warm airs from the Mississippi valley, have found their way.

Happily we are not much troubled with the small boy entomologist—with the "Young Barnes" of the old country, with juveniles, having the greed of acquisition, but not the love of science, who catch for catching's sake. Many a species in England is fast disappearing before the nets of such spoilers. Long may it be before Canada gives birth to such a race. For, of all living things the Rhoplocera are the least hurtful and the most widely attractive. They are beautiful; they are diurnal. For the most part they feed

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## FAMILIES A

Sub-family I . . . .  
Sub-family II . . . .

Six legs fitted

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Sub-family I . . . .  
Sub-family II . . . .

Sub-family III . . . .  
Sub-family IV . . . .

Mostly small inse

*Myioieta Claudia* (see in abundance in the has appeared in the

plentiful. It is seen in localities that have often been visited by this insect that is everywhere in England, where it is found at Camberwell having been introduced from Langton Carr, Lincolnshire, being motionless when at rest, on which the sunbeams, and fairly dissimulated. It resembles *V. Antiopa*, the Admiral, *P. Cardui*. A single specimen was taken at Epton Wood, near Lea. One specimen also of *V. Blomer*, at Withypole, p. 76 and 113). *P. 180* numbers of the *undantly* about every

led Purple (*Limenitis*) met with abundantly on such roads, too, at difficult to catch. It does closely resemble under upon its haunts. The specimens come in the upper story. Fritillary seems to *sduvallii* (Boisduval's

*o Canadensis*) in full *Bellona*, rise as the helpless on the plant. of a curiously shaped lid amongst the blossoms above it, seizes the insect by its beak into the

upper butterfly (*Chrysothrix*) Mere. The *o Phaëton* from that country for the abode of which has brought *Papilio* but lately found its *o Marcellus*, *P. Ajax*, from the Mississippi

st—with the "Young" acquisition, but not the England is fast disappearing. Canada gives birth to the hurtful and the most most part they feed

on weeds, or on plants of little value. *Pieris rapae* (the cabbage butterfly), is undoubtedly the most offensive of the race, but even the farmer who humanely sold his cabbages, which had been attacked by *P. rapae*, because he deemed them unfit for food, met with a ready sale, and no purchaser was known to have been injured by them. Here and there a carrot, or a parsnip, may be somewhat smaller because *Papilio Asterias* has fed upon its top, but surely the beauty of the imago amply pays for the trifling damage done by the larva. Indeed, we may thank God that He has provided such visions of beauty and grace as the butterflies afford, and at so small a cost to the beholders.

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FAMILIES AND SUB-FAMILIES OF THE BUTTERFLIES OF THE PROVINCE OF QUEBEC.

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FAMILY I.

PAPILIONIDÆ.

Six legs fitted for walking.

Sub-family I. . . . . PAPILIONIDI . . . . . Inner margin of hind wing concave.  
Sub-family II . . . . . PIERIDI . . . . . Inner margin of hind wing convex.

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FAMILY II.

DANAIDÆ.

Six legs fitted for walking. Wings rounded, antennæ with long and curved knob.

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FAMILY III.

NYPHALIDÆ.

First pair of legs rudimentary. Only four legs fitted for walking.

Sub-family I. . . . . SATYRIDI . . . . . Spotted insects with rounded wings.  
Sub-family II . . . . . NYMPHALIDI . . . . . Wings rounded. Conspicuous bands on hind wings.  
Sub-family III . . . . . VANESSIDI . . . . . Wings with angular projections.  
Sub-family IV . . . . . ARGYNNIDI . . . . . Tawny, black-spotted insects. Hind wings rounded.

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FAMILY IV.

LYCENIDÆ.

Six legs fitted for walking. Insects of small size.

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FAMILY V.

HESPERIDÆ.

Mostly small insects. Head broad. Antennæ set wide apart. Six legs of equal length.

## BUTTERFLIES OF THE PROVINCE OF QUEBEC.

A TABLE to enable the student of entomology to find readily the name of a butterfly from the size, colour, and leading characteristics of the insect.

Expense of Wings in inches or parts of an inch.	NAME OF INSECT.	PREVAILING COLOUR.	DISTINGUISHING MARKS.
5 $\frac{3}{4}$	Papilio Cresphontes.....	Black.....	Conspicuous yellow spots and blotches. Large tails, each containing a yellow spot.
4	Danais Archippus.....	Fulvous.....	Black veins. Black border spotted with white.
3 $\frac{1}{2}$	Papilio Turnus.....	Yellow.....	Black bands. Hind wings tailed.
3 $\frac{1}{2}$	Papilio Asterias.....	Black.....	Double row of yellow spots. Seven blue spots on hind wing. Hind wings tailed.
3	Limenitis Disippus.....	Fulvous.....	Black veins and borders. Curved black line through hind wing.
3	Limenitis Arthemis.....	Blue-black.....	White band.
3	Vanessa Antiopa.....	Chocolate-brown.....	Buff margin.
3	Argynnis Aphrodite.....	Fulvous.....	Large silver spots on under side of hind wing.
2 $\frac{1}{2}$	Grapta interrogationis.....	Fulvous.....	A golden semi-colon (;) on under side of hind wing.
2 $\frac{1}{2}$	Grapta J. album.....	Tortoise-shell.....	Under side hind wing ash-grey, with a white J in the centre.
2 $\frac{1}{2}$	Pyrameis Atalanta.....	Black.....	White spots, red bands.
2 $\frac{1}{2}$	Pyrameis Cardui.....	Fulvous with a rosy tinge	Under side marbled. Five small eye-like spots near hind margin of hind wing.
2 $\frac{1}{2}$	Pyrameis Huntera.....	Fulvous.....	Under side marbled. Two large eye-like spots near hind margin of hind wing.
2 $\frac{1}{4}$	Argynnis Atlantis.....	Fulvous.....	Resembles <i>Aphrodite</i> , but has dark border to hind margin of all the wings.
2	Pieris oleracea.....	White.....	No spots. Angles near the body yellow.
2	Pieris rapæ.....	White.....	Blackish tips. Female has black spots.
2	Colias Philodice.....	Yellow.....	Black hind border. Black spot on fore-wing. Orange spot on hind wing.
2	Colias Eurytheme.....	Orange.....	Resembles <i>Philodice</i> , of which it is believed to be a variety.
2	Debis Portlandia.....	Brown.....	Velvety black spots. Under side has a rosy gloss.

Expense of Wings in inches or parts of an inch.	NAME OF I
2	Grapta Comma.
2	Vanessa Milberti
2	Grapta Progne..
2	Melitæa Phaeton
2	Eudamus Tityrus
1 $\frac{3}{4}$	Grapta Faunus.
1 $\frac{3}{4}$	Neonympha Bois
1 $\frac{3}{4}$	Satyrus Nephele
1 $\frac{3}{4}$	Argynnis Myrina
1 $\frac{3}{4}$	Argynnis Bellon
1 $\frac{1}{2}$	Melitæa Harrisii
1 $\frac{1}{2}$	Neonympha Eur
1 $\frac{1}{2}$	Phyciodes Thar
1 $\frac{1}{4}$	Eudamus Pylad
1 $\frac{1}{2}$	Chrysophanus E
1 $\frac{1}{2}$	Thecla Acadica
1 $\frac{1}{2}$	Thecla Falacer.
1 3-16	Pamphila Egrer
1 $\frac{1}{2}$	Thecla Niphon.

## Butterflies of the Province of Quebec—Continued.

Expense of Wings in inches or parts of an inch.	NAME OF INSECT.	PREVAILING COLOUR.	DISTINGUISHING MARKS.
2	Grapta Comma.....	Fulvous.....	Under side richly marbled brown, grey and yellow. A silver comma (,) on hind wing.
2	Vanessa Milberti.....	Rich brown.....	Orange-red bands. A row of small blue crescents on hind wing.
2	Grapta Progne.....	Fulvous.....	Under side dark brown, streaked with grey. A silvery hook-like mark on hind wing.
2	Melitæa Phaeton.....	Black.....	Orange and white spots.
2	Eudamus Tityrus.....	Brown.....	Large heart-shaped silver spot on under side of hind wing.
1½	Grapta Faunus.....	Fulvous.....	Resembles <i>comma</i> but is more richly marked. Mottlings of under side have a dark sage green appearance.
1½	Neonympha Boisduvalii.....	Pale yellowish-brown.....	Spots on under side black with white centres and <i>two light rings around each</i> .
1½	Satyrus Nephelè.....	Dark brown.....	Two large black spots on fore wings with <i>bluish-white centres</i> . One light ring to spots on under side.
1½	Argynnis Myrina.....	Tawny.....	Four rows of silver spots on under side of hind wing.
1½	Argynnis Bellona.....	Fulvous.....	No silver spots. A rosy-white gloss on under side of hind wing.
1½	Melitæa Harrisii.....	Fulvous, mottled with black.....	Under side of hind wings has numerous buff blotches and lunettes bordered with black.
1½	Neonympha Eurytris.....	Dark brown.....	Black spots with <i>two lead-coloured dots in each</i> .
1½	Phyciodes Tharos.....	Fulvous.....	Reticulated with black lines.
1½	Eudamus Pylades.....	Dark brown.....	Whitish spots starting from costa of fore wing in two rows and meeting in the middle—one row continued.
1½	Chrysophanus Hyllus.....	Male—Coppery-brown Female—Fulvous.....	Under side of hind wing silvery-grey with orange border and black spots.
1½	Thecla Acadica.....	Brown.....	Numerous small black dots on under side. Conspicuous blue patch interrupting row of orange spots on under side of hind wing. Small tails.
1½	Thecla Falacer.....	Dark brown.....	Light brown underneath with white bordered brown spots. Slender tails.
1 3-16	Pamphila Egremet.....	Brown with rosy blush.....	A few white spots on upper side of fore wing.
1½	Thecla Nippon.....	Rich warm brown.....	Under side lighter. Hind wing banded beneath with warm rich brown.

## Butterflies of the Province of Quebec—Continued.

Expense of Wings in inches or parts of an inch.	NAME OF INSECT.	PREVAILING COLOUR.	DISTINGUISHING MARKS.
1½	Nisoniades Brizo .....	Very dark brown .....	Greyish markings and spots. Two rows of ochre yellow spots near hind margin of hind wing.
1 1-10	Thecla Mopsus .....	Dark brown .....	No tails. <i>Vermillion spots</i> on under side.
1 1-10	Chrysophanus Americana ...	Copper-red .....	Dark brown hind wing with red hind border.
1 1-10	Feniseca Tarquinius .....	Fulvous and brown .....	Under side straw-colour. Hind wing <i>thickly set with light reddish brown, white bordered spots.</i>
1	Chrysophanus Epixanthe ...	Purplish-brown .....	Under side bluish-white with black dots.
1	Lycæna Marginata .....	Satiny-blue .....	Under side bluish-grey with dark markings. <i>No orange crescents.</i>
1	Pamphila Hobomok .....	Fulvous .....	Under side of hind wing has a straw-coloured patch in the centre and a yellow spot near the shoulder.
1	Pamphila Mystic .....	Fulvous .....	Under side of hind wing has a curved row of seven straw-coloured spots.
1	Pamphila Wamsutta .....	Dark brown .....	Under side of hind wing has two large connected irregular yellow patches.
1	Pamphila Manitoba .....	Fulvous .....	Under side of hind wing has two curved rows of silvery spots.
¾	Lycæna Comyntas .....	Male—Violet blue. Female—Black, glossed with blue .....	Thread-like tail. Orange crescents on under side.
¾	Pamphila Ahaton .....	Light brown .....	Under side of hind wing yellowish-brown.
¾	Ancyloxypha marginatus .....	Tawny yellow .....	Under side hind wing yellow.
¾	Pyrgus Centaureæ .....	Dark brown .....	Black and white fringes. Under side glossy reddish-brown.

## NOTES ON THE GENUS CALLIMORPHA.

BY F. B. CAULFIELD, MONTREAL.

Read at annual meeting of the Ent. Society, Oct. 14th, 1885.

I have endeavoured to give a few brief notes on our *Callimorphas*. I have only seen four Canadian species, one buff, *interrupto-marginata*, and three white *Lecontei*, *contigua*, and one unnamed species which generally passes for *Lecontei*, but certainly is not that species, as I have bred both species and the larva of *Lecontei* is larger, and the colours are duller than those of the larva of the smaller species. *Lecontei* has several varieties, such as *militaris*, Harris, and *confinis*, Walk, and these varieties have much more white on the

W

HESPERI

Pamphila.

Hobomok.

Mystic.

Wamsutta.

Metacomet.

Manitoba.

Egremet.

Ahaton.

T. H. MULLER; LINE F  
Darwin; Cross and Self.

MARKS.

W

Two rows of hind margin of

n under side.

red hind border.

hind wing *thickly brown, white bor-*

h black dots.

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as two curved rows

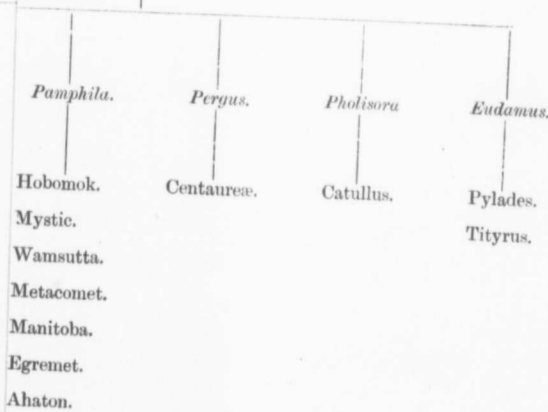
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yellowish-brown.

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Under side glossy

*HESPERIDÆ.*

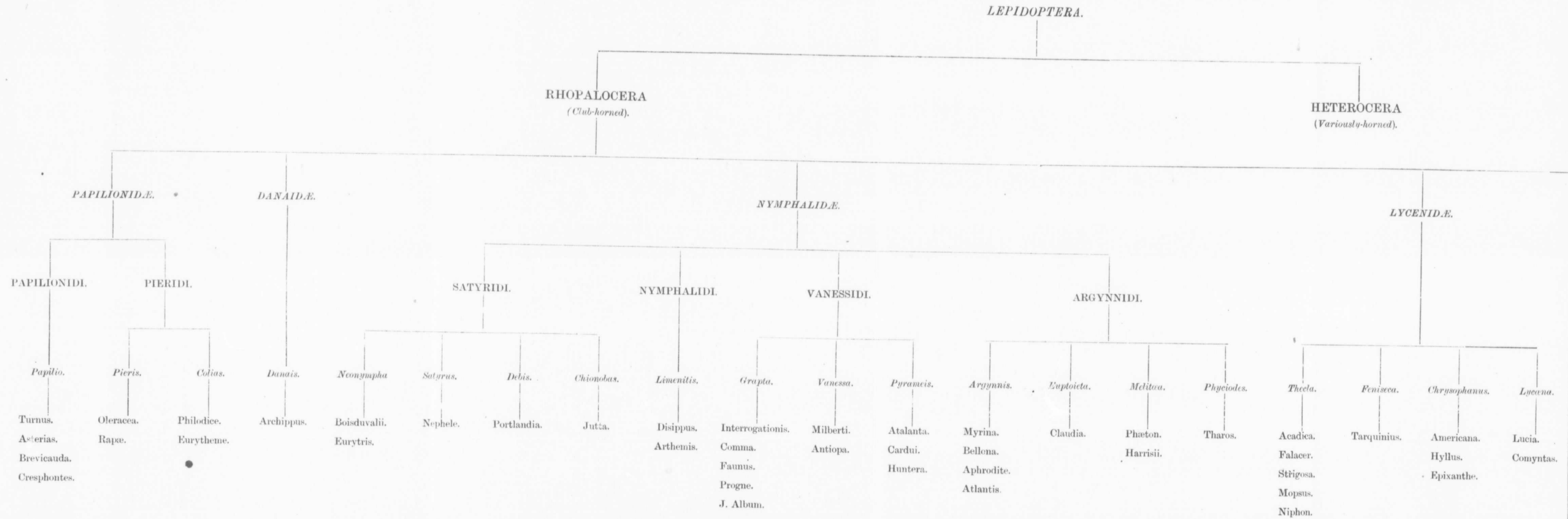


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† H. MULLER; THE PERMISSIBILITY OF FLOWERS. TRANSLATED BY E. DARWIN. LONDON, 1833.  
Darwin; Cross and Self-fertilisation of Plants; London, 1876.

85.  
  
I have only seen  
*Lecontei, contigua,*  
mainly is not that  
and the colours are  
several varieties, such  
more white on the

A SYSTEMATIC VIEW OF THE BUTTERFLIES OF THE PROVINCE OF QUEBEC.





A SYSTEMATIC VIEW OF THE BUTTERFLIES OF THE PROVINCE OF QUEBEC.

LEPIDOPTERA.

HETEROCERA  
(Variously-horned).

NYPHALIDÆ.

LYCENIDÆ.

HESPERIDÆ.

ALIDI.

VANESSIDI.

ARGYNNIDI.

dis.

*Grapta.*

*Vanessa.*

*Pyramcis.*

*Argynnis.*

*Euptoieta.*

*Melitæa.*

*Phyciodes.*

*Thecla.*

*Feniseca.*

*Chrysophanus.*

*Lycæna.*

*Ancylorhiza.*

*Thanaos.*

*Pamphila.*

*Pergus.*

*Pholisora.*

*Eudamus.*

us.

Interrogationis.

Milberti.

Atalanta.

Myrina.

Claudia.

Phæton.

Tharos.

Acadica.

Tarquinius.

Americana.

Lucia.

Marginatus.

Brizo.

Hobomok.

Centaurea.

Catullus.

Pylades.

is.

Comma.

Antiopa.

Cardui.

Bellona.

Aphrodite.

Harrisii.

Falacer.

Strigosa.

Hyllus.

Comyntas.

Epixanthe.

Mystic.

Wamsutta.

Metacomet.

Tityrus.

Faunus.

Huntera.

Atlantis.

Mopsus.

Progne.

J. Album.

Nippon.

Wamsutta.

Metacomet.

Manitoba.

Egremet.

Ahaton.

Expanse of Wings  
in inches or parts

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The accompanying  
attacked, and were  
but nobody could e

\* See McAlpine's

† H. Müller; The  
Darwin; Cross and St

wings than the type, or in other words it varies in the direction of albinism, while in the smaller species the reverse is the case, this species varying in the direction of melanism, in some specimens the white spots being almost entirely covered. The smaller species is, I think, common in Ontario, while *Lecontei* seems to be scarce. Some years since I saw a number of the smaller type in Mr. Brodie's Toronto collection, but he told me he had not met with the larger form. *Contigua* is a well marked form and varies very little, but as I have no specimens at hand I cannot point out the distinctive features. I am, however, satisfied that breeding the larva will in time prove that we have three white-winged species, *Lecontei*, *contigua*, and the smaller form which now does duty for *Lecontei*.

These three white species occur in Montreal, and the smaller form and *contigua* are found in Ontario. *Interrupto-marginata* is found in Ontario, but as far as known to me does not occur in Quebec.

### INSECTS AND ORCHIDS.

BY J. A. GUIGNARD, B.A., OTTAWA, ONT.

Without plants, animal life would be impossible on our globe; but likewise, most flowering plants depend entirely for their reproduction on some animal agent. It has even been found that, under water, some Infusoria of the genus *Vorticella* play a part in the fertilisation of Red Sea weed, *Polysiphonia subulata*.\*

Experience teaches that cross-fertilisation is far more advantageous than self-fertilisation, or, as Charles Darwin expresses it, that "nature abhors perpetual self-fertilisation;" and observation has brought to light in flowers an endless number of contrivances, each one more admirable than the others, in order to insure crossing. Thus, in certain orders, as for instance the grasses, wind carries the powdery pollen from the open anther-cell of one flower to the viscid stigma of another. Generally, however, this office can be effected only by peculiar, mostly winged, visitors. Each flower then prepares for them either a store of nectar or a superabundance of pollen, as an attraction and reward for the services unconsciously rendered. Some freely display their treasures to all guests, large and small; others conceal them more or less, and privileged visitors only can then gain access to the feast, owing to their special size, shape, habits or intelligence. Each species of plant presents in this respect its own peculiarities. Hence it is easy to understand the number of discoveries yet to be made in this field. In order to be convinced of it, one has only to read a few pages of such works as those of Darwin and Hermann Müller,† giving the results of their researches in Europe. At every page new surprises await the reader. There are constantly new forms of the organs, new arrangements of the parts, new processes with which they are furnished, new successions in the time of unfolding or of maturing anthers and stigma, new motions in many cases, one might nearly say new tricks, for all of which it is not easy to find explanations.

Such studies may not have an obvious practical utility. But, besides the pleasure which is always derived from perceiving new beauties in nature, our existence is so closely bound to that of plants and animals that valuable results cannot but be expected from these researches. I may, perhaps, be allowed to quote in this connection part of a delightful article of Mr. G. H. Gibson, in *Harper's Magazine* for December, 1881,— "Among our Footprints."

"The late Prof. Wood, the botanist, had received from a bee-keeper in California, together with a most appealing letter, a small box of dead bees, all of which were heavily laden with a thick covering of very small paddle-shaped substances of a brown colour. The accompanying letter stated that thousands upon thousands of the writer's bees had been attacked, and were dying of the strange disease. He supposed it to be a kind of fungus, but nobody could explain it or suggest a cure. His business was threatened with ruin,

\* See McAlpine's Botanical Atlas, Edinburgh, 1883.

† H. Müller; The Fertilisation of Flowers. Translated by D'Arcy W. Thomson; London, 1883. Darwin; Cross and Self-fertilisation of Plants; London, 1876.

and in his extremity he appealed to professional skill for a remedy. Mr. Wood was not long in ascertaining the cause of the trouble. A small magnifier revealed the fact that the so-called fungus was nothing more than the sticky pollen of a certain milk-weed. He wrote immediately to his correspondent stating his discovery, and told him to search the country for several miles in his neighbourhood, and he would somewhere surely discover a large tract of this mischievous *Asclepias*. In about a fortnight he received another letter confirming his theory. The plant abounded in the locality. It had, therefore, been cut down before the scythe, after which the trouble had ceased."

If the modes of fertilisation of all plants deserve our attention, each flower having its own mysteries to be solved, it is pre-eminently the case for Orchids. The flowers in this order are shaped on a type so different from those of any other, that they seem to belong to a world of their own. Their endless variety of form, to which are often added the most exquisite colours, has always attracted notice; but the interest in them has been considerably enhanced by the discovery in these peculiar shapes, of wonderful and minute contrivances to make use of the visits of insects for cross-fertilisation.

Charles Darwin gave much attention to this subject, and published the result of his researches in his admirable work "On the various contrivances by which British and Foreign Orchids are fertilised by Insects, and on the good effects of Interbreeding." When the first edition appeared in 1862, Prof. Asa Gray examined twenty-two American Orchids, and wrote some valuable articles on the arrangement of the organs, and the mode of fertilization of their flowers, (*American Journal of Science and Arts*, 1862, 1863). But no visits of insects were then recorded by him, and, altogether, very few seem to have been observed on North American Orchids. Prof. Gray mentions one insect visitor in the last edition of his Botanical text book; but Prof. S. I. Smith, of New Haven, Conn., in the summer of 1863, was so fortunate as to see five species of insects on orchidaceous flowers, or loaded with their pollen (*Proceedings of the Boston Society of Natural History*, vol. ix, page 328). I cannot find any other instances recorded beside those six, to which I shall add a few more.

All that is known of the structure, habits, haunts, cultivation of the Orchids of New England, has been summed up in a beautiful little volume\*, by Mr. Henry Baldwin, who well deserves the thanks of all lovers of Botany. To what is gleaned from former writers, there are added the results of his own observations, as well as notes from other naturalists, and the work is most valuable for Canada, where the list of native Orchids is nearly exactly the same as in New England. Mr. Baldwin treats of the different flowers in the order of their dates of blossoming; but I shall bring together the similar features and characters by following the natural order of the genera according to Bentham and Hooker's "Genera Plantarum."†

These authors divide the order Orchids into five tribes: *Epidendreae*, *Vandeeae*, *Neottieae*, *Ophrydeae*, and *Cypripediaceae*, of which the second only is unrepresented in the Dominion.

The flowers of the *Cypripediaceae* have two fertile anthers, one on either side of the column, and nearer its base than the three-lobed or rather three-fold stigma. Their pollen forms on the anthers a viscid layer, which is detached and carried away by insects in much the same way as the pollen of most flowers. The other tribes present great differences in these respects. In the first place, their flowers possess only one anther, which is situated at the extremity of the column. Then, their pollen is found in the two cells of the anther, cohering in elongated masses, or pollinia, which are provided at one end with a drop of viscid matter secreted by the rostellum, which is one of the three stigmas transformed. The pollinia thus stick fast readily to whatever comes in contact with the viscid end, and are by this means withdrawn from their cells. This arrangement recalls that in the milk-weed mentioned before, though in that case, the pollinia

\*The Orchids of New England. New York, 1884. J. W. Wiley & Sons. The book is illustrated with 40 figures, of which 15 are fine full-page plates. One cannot help, however, finding fault with some figures. Instead of representing the bold and straight lines in the plants, there has been sometimes an attempt to improve upon nature by curving stalks and leaves in a painful distortion, painful at least to a botanist.

† Vol. III. London, 1888.

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#### TRIBE EPIDENDREAE

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#### TRIBE NEOTTIEAE

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become fixed to the legs and hairs of insects in a different way, viz., by means of a horny hook with a slit. The object is, however, evidently the same, to bring about crossing by the agency of insects.

TRIBE EPIDENDREAE—(*Microstylis*, *Liparis*, *Calypso*, *Aplectrum*, *Corallorhiza*, *Tipularia*.)

The anther in this tribe is covered by a lid which falls away or opens at maturity so as to expose more or less to view four pollinia, arranged in pairs in each cell. The lid of the Spring Coral-root, *Corallorhiza innata*, must fall very soon after the expansion of the flower, for I could never find it except in buds. The stigmatic surface is turned downward, so that it does not seem possible for the pollen to reach it spontaneously. I have only once found a pollinium on a stigma of a Tway-blade, *Liparis Loeselii*; but capsules are generally formed in great number.

As far as I can ascertain, no insect visitor of the flowers of this tribe is yet known. Only surmises can, therefore, be made from the shape or size of the flowers. The Adder's Mouths (*Microstylis*) must require very small insects to effect the pollination of their minute flowers, while only a large bee standing on the sack-like lip of the *Calypso borealis* could touch with its back the anther above, and extract the pollinia for the benefit of the next flowers visited.

The rare Crane-fly Orchis, *Tipularia discolor*, presents two characters exceptional in this tribe, a spur to its lip, and its pollinia connected by a stipes or stalk to a viscous gland on the rostellum.

The shortness of the remarks on these plants, will, it is to be hoped, be an incentive to attentive walkers in the woods and meadows, to ask each of their flowers some of its secrets, whenever there is the opportunity. What visitors does it receive? What attraction does it offer? How do the guests behave?

TRIBE NEOTTIEAE.—(*Listera*, *Spiranthes*, *Goodyera*, *Epipactis*, *Arethusa*, *Calopogon Pogonia*.)

The great distinctive character of this tribe from the Epidendreae is the less cohering pollen, which is granular or powdery, and not waxy.

In some, *Listera*, *Spiranthes*, *Goodyera*, and *Epipactis*, the anther-lid opens in the bud, and the protruding ends of the pollinia become then fixed to the rostellum; afterwards, when the flower has opened, the least contact even of a human hair, causes the surface membrane of the rostellum to rupture or explode, a portion of the rostellum adhering immediately by its viscosity to the foreign object, which on removal draws the pollinia out of their cells. In the European Ladies'-tresses, *Spiranthes autumnalis*, and Rattlesnake Plantain, *Goodyera repens*, the viscid strip thus carried away from the beak-like rostellum, is boat-shaped, and leaves the two sides of the beak sticking up like a fork. The flowers are proterandrous, that is, they ripen the pollen before the stigma; at least, when the pollinia are in a condition to be removed, the column is so bent down against the lip which secretes nectar at its base, that a pollinium cannot be brought against the stigma, though a bee should come loaded with one or more. In older flowers, the column is found turned upwards, and pollination of the stigma can then take place. Darwin saw humble-bees fertilise *Spiranthes*, alighting on the bottom of the spike, and crawling spirally up it, suck one flower after another. The same insects have been observed in Scotland and on the Alps, at work on the flowers of *Goodyera repens*, a species which also occurs in Canada, as well as two more, *G. pubescens* and *G. Menziesii*. Mr. J. Fletcher has in his herbarium a specimen of *G. pubescens*, with the head of a dipterous fly sticking to the rostellum of one of the flowers; the insect, too feeble to remove the pollinia, had perished miserably. Many similar instances have been observed on other species. Darwin mentions one on *Epipactis latifolia*, which belongs to the same tribe. It is not unusual to find dead ants and flies on the inflorescence of the milk-weeds, hanging by one leg on the horny hooks of the pollinia. Even large Lepidoptera may be unable to free their proboscides cemented to the pollen of the little flowers of *Apocynum androsaemifolium*. I found last summer a dead *Ctenucha Virginica*, which had been thus caught.

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More details, with figures, reproduced from Darwin, are given on *S. autumnalis*, in Baldwin's "Orchids of New England." The same work contains on *Listera ovata* a similar extract, also illustrated, from Müller who saw a Coleopterous insect and several different Ichneumonidae fertilise the flowers. We have yet to discover what insects render the same service to the Canadian *Listera cordata* and *L. convallarioiodes*. As *Epipactis gigantea* is found in the west, I add here that wasps, honey-bees, and flies fertilise two of its European congeners. Another species is, however, known to be self-fertilising.

After these several genera common to both sides of the Atlantic, we come to three others, more interesting to us, as they do not occur in Europe. *Arethusa*, *Calopogon*, and *Pogonia*, belong also to a different subtribe, the Arethuseae, in which the very short rostellum has no viscid gland, and the lid-like anther is inverted above it, so as to bring next to the rostellum that end of the pollinia which, in most Orchids, is turned in the opposite direction. The other end of the pollinia is, however, viscid as usual, but pointing towards the back of the column. How this viscosity originates at such a distance from the rostellum, is, I believe, not yet understood. The anther does not open of itself as in the before mentioned Neottieae, but remains tightly closed in the clinandrium, until some force applied on its edge in an outward direction, lifts it out, swinging on its elastic hinge-like filament. If released, it immediately falls back into its place, provided it has not been too roughly handled.

I have as yet seen only *Calopogon pulchellus* and *Pogonia ophioglossoides*, whose large and lovely flowers appear to such advantage on the tender green of the bog-mosses. The structure of the latter has been well described by Dr. S. H. Scudder in an article in the proceedings of the Boston Society of Natural History (1863), which is also to be found in Mr. Baldwin's book. The column lies over the lip by which it is partly enclosed, but there is left under it a kind of tube through which the visitor may with some effort creep first under the anther, then under the long stigma, and finally reach the peculiarly perfumed nectar at the bottom of the tube. The insect, on withdrawing, brushes against the fringed lid of the anther, and inverts it, thus bringing the upper viscid ends of the pollinia down against its back; and if they stick fast to its body, it is enabled to perform the pollination of other stigmas. The anther is remarkably thick and massive: the pollen cells form but a very small part of its volume. Hence, after having been raised it falls by its weight into its first position, and the cells are thus brought back into the clinandrium which shelters them perfectly as before. Consequently, if all the pollen has not been taken away by a first visitor, it may be by a second. The insects must evidently be rather small to be able to pass under the column, and, further, must be winged, for entrance by creeping up the stem and the sides is prevented by the petals and sepals, while, on the other hand, the lip spreads forward, carpeted with fringes, as a most convenient alighting place for winged visitors.

The flower of *Calopogon* is very differently disposed, all the parts being widely expanded and separate. It is unique among Canadian orchids, in that its ovary does not twist when the flower opens, so that the lip keeps the same position that it had in the bud, and remains the highest part of the flower. The sepals and lateral petals are lanceolate and about equal. The lip, which is a little shorter, widens out above into a vexillum similar to that of some Leguminosae, but its anterior face is ornamented with white and yellow hairs, which contrast beautifully with the brilliant purple of the rest of the flower; and the whole cannot but attract from afar the attention of insects in quest of booty. The lip is articulated a little above its base, where in the bud it is folded at a right angle while lying over the column. When the flower expands, the lip is the last part of the perianth to open out. It then becomes erect and keeps that position for three or four days. Then only can the pollinia be withdrawn from the anther, and fertilisation take place; for afterwards the lip falls down again into its original position on the column and covers up both the stigma and the anther.

The winged petaloid column projects forward: it is peculiar both for its length and for the small dimensions of the anther and the stigma, which form a scarcely noticeable swelling at the truncated extremity. The inner and upper surface of this swelling is the stigma, under which the anther rests in the clinandrium. A slight outward pressure on the edge of the lid opens it, and it is seen to be divided by a thin partition into two cells,

each of which comes next to the hinge touching this viscid

That some are, in fact, stated before, are violently shaken, which are connate the spur of the ovary to draw from this the sweets. Then their legs as is the

Though I saw empty cells and nectar was a humble-bee but unfortunately anther. However bend down the column foothold. In its mouth often, if not always, uous stigma or to puncture juicy part a well-known trick through from the *vulgaris*, the common

By holding such saw that the form latter lifted it with struggles to free it them. Self-fertilisation *Pogonia*.

In this tribe, places by a slit also pollinium. The cells with the two glands pouch, and are covered the contrary naked any object, they fall contracting in a pouch to bend down from with them is replaced against the anther in *Habenaria* (in Darwin was the first details as conducting of honey, and he was insects. "Sprengel's flower, suggested that passed on to some insect visitor should that possibly the insect My own direct observations Darwin's account." have been seen in

each of which contains two bright yellow pollen masses connected together at the end next to the hinge by a viscid drop; the pair is, therefore, drawn out at once by any body touching this viscosity.

That some animated agent is required to affect the pollination is manifest from the fact, stated before, that the anther never opens of itself, not even when the flower is violently shaken. There is indeed no free nectar, but the basis of the lip and of the column, which are connate, are thickened around a small depression which seems to correspond to the spur of the other genera, and are as if swollen with juices. To insects knowing how to draw from this store, the winged column offers a most convenient stage while sucking the sweets. Then the anther is behind them and the pollinia must become attached to their legs as is the case with the milk-weed.

Though I paid many visits to a *Calopogon* plot, and noticed many anthers with empty cells and many stigmas pollinised, I only once saw an insect visit a flower. It was a humble-bee as it was just alighting on a column, its head towards the labellum; but unfortunately it flew away frightened by my presence, without having raised the anther. However, it was easy to understand that so large an insect must by its weight bend down the column, when the edge of the swelling at its apex would thus offer a sure foothold. In its movements, the bee cannot but invert the lid of the anther, and then often, if not always, the pollinia will be fastened to a leg and carried either to the contiguous stigma or to that of some other flower. Humble-bees are, moreover, known to puncture juicy parts of flowers, as I shall have occasion to mention later, and they have a well-known trick with long honey-tubes, to save themselves trouble, of biting them through from the outside. This may frequently be seen in the flowers of *Linaria vulgaris*, the common Toad-flax, and the Garden *Antirrhinum*.

By holding successively a house-fly and then a meat-fly over the anther of a *Calopogon*, I saw that the former was not strong enough to produce any effect on the lid, while the latter lifted it without difficulty, and soon had the pollinia attached to its legs; in its struggles to free itself, the insect then brought them against the stigma, which retained them. Self-fertilisation seems thus not to be so well guarded against as in the case of *Pogonia*.

#### TRIBE OPHRYDEÆ.—(*Orchis*, *Habenaria*.)

In this tribe, the anther is adnate to the apex of the column. Its dehiscence takes place by a slit along the whole length of the two cells, which contain each a granular pollinium. The caudicles into which the pollinia are produced, become then connected with the two glands of the restellum. In the genus *Orchis* these glands are protected by a pouch, and are contiguous, coalescing even into one; in the genus *Habenaria*, they are on the contrary naked and more or less distant from each other. As soon as they adhere to any object, they flatten out into a disc, which has generally the remarkable property of contracting in a peculiar direction, and in about half a minute or more of time, causing to bend down from an erect position to a nearly horizontal one. If now the object loaded with them is replaced in a flower in the same position as before, the pollinia strike not against the anther cells, but exactly against the viscid stigma situated lower down, and in *Habenaria* (in consequence of a simultaneous movement of rotation) between the cells. Darwin was the first to describe this movement of depression, and he understood all the details as conducive to regular fertilisation, but in the English Orchises the spur is devoid of honey, and he was long unable to discover what could attract the absolutely necessary insects. "Sprenzel, who supposed that the pollinia were applied to the stigma of the same flower, suggested that the insect visitor came in search of honey, and on finding none, passed on to some other kind of flower. But it was essential for Darwin's theory that the insect visitor should visit a number of the flowers in succession, and Darwin suggested that possibly the insects pierced the delicate tissue of the spur and sucked the included fluid. My own direct observations have confirmed this view, as well as every detail of the rest of Darwin's account." (Müller.\*) Hive-bees and humble-bees, also an *Empis*, a dipterous fly, have been seen in Europe to pierce the inner wall of several kinds of *Orchis* with the

\* See also Am. Nat., pp. 280 and following.

points of their maxillae, the punctures being visible from the outside as small elongated specks. (Darwin, Müller.)

I give these particulars rather in connection with what I said before on *Calopogon*; for in the Canadian Orchises the spur is a true nectary; during the two or three days before the dehiscence of the anther, free nectar is secreted in the spur, until it fills about a third of its total length.

The flower of *Orchis rotundifolia* resembles very much that of *O. mascula* described by Darwin. The sepals and lateral petals are independent from each other, and the lobed, white, and spotted lip is nearly horizontal, forming a most convenient stage for its visitors, probably small Andrenidae.

The flower of the other Canadian species of the genus *Orchis*, *O. spectabilis*, differs in several respects. The five upper parts of the perianth are united, forming over the column a galea not unlike that of many Labiatae, while the ovate lip is entire and smooth; a more important point of difference is that it hangs down, thus facilitating approach to the Sphingidae or hawk-moths, which are wont to remain poised on the wing while inserting their proboscides into the nectaries; and the showy white of the lip, contrasting with the delicate purple of the galea above, joined to the absence of perfume, naturally leads to the inference that the moths are day-flying species. Is not also the nearly straight and cylindrical spur admirably fitted for the slender beak of the ruby-throated humming-bird? However, the nectar is doubtless accessible as well to the larger bees, whose tongues can easily be lengthened as far as the bottom of the spur; and none of the guests mentioned could in their interested visits avoid contact with the viscid glands that keep watch over the entrance to the nectary.

Mr. E. Malan in "Science Gossip," 1885, p. 101, says that, in the European *O. mascula*, "a warm cloudy morning is necessary to enable the pollinia to escape freely, and indeed, it is only on such a morning that I have ever seen humble-bees visiting the plant." From this may be understood the importance of noting as far as possible not only the dates of observations, but also the hour of the day and state of the weather.

In our second genus of the Ophrydeae, *Habenaria*, we have here at last some Canadian species of Orchids, of which some insect visitors are well-known. Pollinisation has even been observed repeatedly on one species. Prof. A. Gray, in the Journal of Science and Art, gave in 1862 and 1863 the results of his careful examination of twelve species in reference to their fertilisation; in the last edition of his Botanical Text-Book, he names and figures a moth bearing pollen-masses of the largest species, *Habenaria orbiculata*. As Mr. Baldwin gives in his book all the important details from these and other sources, I shall scarcely do more than recall the principal features of each species.

There are extraordinary differences in the dimensions of the flowers and in the shapes of their organs. The nectary is either sack-shaped, conical, or long and thread-like; its entrance may be wide open, or contracted, or obstructed by projections of the column or the lip. The upper petals and the sepals are in some species grouped as a roof over the column, in others they are thrown back so as to allow a side approach. In some the lip hangs down in the shape of a strap (Latin, *habena*), in others it projects forward with its end either pointed or spread out into three fan-like and fringed lobes, etc.

The lip of *H. dilatata*, though narrower, entire, and slightly curved upwards, seems, as in *Orchis rotundifolia*, destined to serve as a standing place for insect visitors. No movement of depression or rotation, says Prof. Gray, was detected in the caudicles of the pollinia after their removal from the cells. The stigma being much narrower and situated higher than in *Orchis*, such a movement is less necessary. The narrowness of the lip naturally increases the chances of the pollinia brought by an insect being directed straight to the stigma in the narrow throat of the flower.

*H. virescens* and *H. viridis*, var. *bracteata*, have their flowers disposed so as to oblige insects to approach the spur from the sides. In the former a "nose-shaped protuberance" on the base of the lip divides in two the orifice of the spur. The latter species, the type of which, *H. viridis*, is found in England, has been described by Darwin, who, from the presence of a ridge down the hanging lip, and of two nectar secreting spots directly under the rostellum glands, concluded that insects must alight on the right or the left and detach only one pollinium at a time.

By the side aid, it is surprising morphologically. The pollinia of fall out of the anther, and, when the flower is closed. In the other species are found detached clavate and viscid copious tubes. extraordinary the functionless. In brought against the thus crossing is (Stethobaris tuberosa) also one of the occasionally at length.

The larger and *fimbriata* has of an inch and a the pendant lip prompt movement to the rapid flight Gray's Botanical attached to its were made another day at the bottom of in turn. When near the base." frequently saw the flowers of the although pollinia

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\* See also Mr. figured in the usu



By the side of the former species in which every part insures crossing by extraneous aid, it is surprising to find two others which are self-fertilising: *H. hyperborea*, which morphologically is most similar to *H. dilatata*, and the very-small-flowered *H. tridentata*. The pollinia of the former, having very weak and attenuated caudicles, very commonly fall out of the anther cells, while the lip is not yet expanded, or even in the closed bud, and, when the flower opens, they topple over and fall upon the broad stigma beneath. In the other species, the pollinia do not fall bodily out of the cells, but packets of pollen are found detached from them even in the bud, having already fallen down on three clavate and viscid processes of the rostellum into whose substance the pollen sends down copious tubes. The rostellum seems, therefore, to act as a true stigma; hence it is less extraordinary that the normal stigmatic surface under it should to all appearance be functionless. In both species, however, the glands are perfect, and stick fast to a bristle brought against them, when the pollinia, or what may be left of them, is easily drawn away; thus crossing is still possible. Mr. J. Fletcher has indeed found as many as three weevils (*Stethobaris tubulatus*, Say) on flowers of *H. hyperborea*; Mr. W. H. Harrington caught also one of the same species on a flower of *H. psycodes*. This weevil may, therefore, occasionally at least pollinise the stigmas.

The larger-flowered *Habenaria orbiculata*, *ciliaris*, *blephariglottis*, *lacera*, *psycodes*, and *fimbriata* have a very long thread-like spur, reaching in the first species to a length of an inch and a half. The nectar can evidently be obtained by long-tongued Lepidoptera; the pendant lip shows that they must be hawk-moths which feed without alighting. The prompt movement of depression of the pollinia when drawn out of their cells corresponds to the rapid flight of the moths darting from flower to flower. The moth figured in Prof. Gray's Botanical Text-Book, *Sphinx drupiferarum*, carries two pollinia of *H. orbiculata*, attached to its eyes, proof positive of a previous visit to a flower. But direct observations were made already in 1863 by Prof. S. I. Smith. He watched a *Sesia Thysbe*, and on another day a *S. diffinis* sucking nectar from flowers of *H. psycodes*.\* "They commenced at the bottom of the spike, and, proceeding spirally upward, visited every opened flower in turn. When caught they had twenty to thirty pollinia sticking to the proboscides near the base." The same observer took also a *Papilio asterias* similarly loaded, and frequently saw "the orthopterous insect, *Phaneroptera curvicauda*, Serv., feeding upon the flowers of the Orchid; but could not find that it ever effected fertilisation in any way, although pollinia were several times found attached to its feet."

The anther-cells of *Habenaria Hookeri* are wider apart than in the above species, and consequently a moth arriving in front could easily obtain nectar without touching either gland, but an examination of the flower convinces one that the insect must approach from the side; for the lip curves its point upward, while its edges are turned down on both sides and the lateral sepals are thrown backward. Above all, the orifice of the nectary is heart-shaped, in order to guide more surely an insect's proboscis against the gland above.

Before leaving the genus *Habenaria*, I shall mention the surprising contrast of another species of this continent with the preceding. *H. nivea* of Delaware has like *Catopogon* an untwisted ovary and consequently the spur is turned upward (Gray's Manual, 5th Ed. page 681). How pollination takes place with this inverted disposition, is indeed a puzzling question. The legs of an insect will very likely be found to be the means of cross-fertilisation.

#### TRIBE CYPRIPEIDÆ.—(*Cypripedium*.)

The large inflated lip in the flowers of the Lady's slippers presents an opening above, while its basal portion is narrower and folded towards the column on both sides so as to form a tube, the roof of which is composed of the sterile stamen or staminodes and the stigma. The edges of the lip overarch all round, except near its base where they leave two symmetrical openings under the two anthers on either side of the base of the column. The pollen is too glutinous to become detached spontaneously from the anthers, and moreover the stigmatic surface is directed downward as if to prevent anything falling upon it. It requires, therefore, a peculiar agent for the pollination.

\* See also Mr. Gibson's article in *Harper's Magazine*, Dec. 1881, where the plant and a hawk-moth are figured in the usual tasteful style of that publication.

My attention was especially drawn to the present subject by discovering in June 1882, a dipterous fly imprisoned in the large yellow lip of a plant of *C. pubescens*, which I had under cultivation. The insect either had been attracted by the sweet odour or had resorted to the flower as a convenient shelter on the previous evening, but had not been able to get out again. It never attempted to escape by the wide opening above; for hours it strove to force its way under the column, but being too large to pass beneath the stigma, it always fell back into the cavity of the lip. On the next day, the fly was still in its trap, but motionless. I supposed it was exhausted and took it out, but it flew away immediately.

I then placed into the same flower a smaller fly which very soon disappeared under the staminodes and arrived at one of the posterior openings. There, however, it could pass only its head: the glutinous pollen of the anther held it fast by the thorax and all its efforts to regain its liberty were useless. As the flower matures, the pollen becomes less cohering and the tissues of the lip less rigid; the insect might have been thus released, but I took upon myself to do the work. I had some difficulty, as I wished to injure neither the insect nor the flower. I then noticed how rigid the edges of the lip is under the aperture, and how it is further maintained in its position by the pointed tip of the filament of the anther.

Having disengaged the fly, I gave it its liberty, but carrying away a lump of pollen firmly fixed on its thorax. It had not occurred to me that it might have been still of use to me; for, it was now easy to understand that if the insect with its thorax thus coated with pollen had been placed in a flower, it could not fail to follow in it the same way and to leave pollen on the stigma when passing under it, for the walls of the lip close on either side so as to leave no passage but under the stigmatic disc, which is beset with rigid papillae evidently destined to retain the pollen. A smaller fly, however, was soon found, I besmeared its thorax with pollen and placed it in the lip of a flower. I had the satisfaction to see it nearly immediately come out at one of the back apertures, and without difficulty as it was smaller, but, however, having fulfilled its mission and pollinised the stigma. I may add here, that the flowers thus fertilised produced perfect capsules, though I had never before obtained any on my cultivated plants, on account, no doubt, of the absence in the city of the insects by which in a state of nature the flowers are usually visited.

I could not doubt that such must be the mode of fertilisation, though Darwin, in the first edition of his work on the Fertilisation of Orchids published in 1862, expressed the opinion that pollination was performed by some insect's long proboscis inserted through the openings at the back. And I found afterwards that the inadmissibility of that view had been seen long ago by Prof. Gray, who first understood that insects must enter bodily the flowers of *Cypripedium* and visiting several flowers in succession bring about cross-fertilisation, (*Journal of Science and Art*, Nov. 1862). In 1863, Prof. S. I. Smith, saw some flowers of *C. spectabile* almost covered by numbers of small flower-beetles, some of which eventually pollinised the stigma.\* Mr. J. Fletcher in 1884 observed also on the same plant that same insect, which has been identified only last winter as being *Anthobium convexum*. Prof. Smith adds: "Of many flowers from different places, nearly all had had the pollen removed in minute particles from the anther to the stigma; but, in two or three instances, the pollen had been removed in one mass as if by some large insect." These observations have the peculiar interest of having probably been the first made on this continent of the actual fertilisation of orchids. They also justified Prof. Gray's theory, that the insects entered the flowers, but though self-fertilisation was thus effected, crossing could scarcely ever occur, and the arrangement of the organs of the flower is obviously destined as in other orchids to insure the transport of pollen to the stigma of another, as in other orchids, and as had probably been the case in the three instances mentioned by Prof. Smith, when he found large masses of pollen on stigmas. In 1868 an observation of Dr. H. Miller on the *Cypripedium calceolus* of Europe, confirmed definitively Prof. Gray's view: the German professor found in a flower a bee, *Andrena pratensis*, and saw the plant fertilised by it and afterwards also by four other species of the same genus.†

\* Proceedings of the Boston Soc. of Nat. Hist., Nov. 1863.

† American Naturalist 1871, p. 285, and Müller's Fertilisation of flowers.

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I have also tried to ascertain which are the natural visitors of our Lady's slippers. In the summer of 1883, I could find in *C. pubescens* only a dead Buprestis, *Anthaxia inornata*, perhaps overpowered by a yellow spider, that had possession of the lip and had spun some threads in it. The beetle is a well known flower-loving species. This spider is frequently found in the flowers of this lady's slipper, and so must get in them sufficient prey to repay it. On another occasion, I found in a lip an *Andrena nivalis*, but also dead; it had very likely been unable to escape from the flower on account of its too large size, for it had no traces of pollen on its thorax and was consequently at its first visit. At last, this summer, Mr. W. H. Harrington captured a live *Osmia vicina* on the lip of a flower: it had its thorax all besmeared with pollen and must have had a hard struggle to free itself from the gummy anther, for it seemed nearly helpless.

With *C. spectabile*, I was a little more fortunate; I first caught on the 2nd of July 1883, a *Megachile melanophœa* in the lip of a flower. On the 21st of June 1884, I obtained in the same Lady's Slipper—

Two bees: *Megachile centuncularis*, St. Farg; *Anthophora terminalis*, Cress.

One beetle: *Trichius affinis*, Gory.

Three Lepidoptera: *Pamphila Cernes*, Bd. et. Lec.; *Pamphila Mystic*, Scudder; *Eudamus Tityrus*, Fabr.,

and also several smaller moths which went freely in and out by the medium opening of the lip. As for the three Lepidoptera named above, which nearly entirely filled up the lip, I regret, in my hurry to secure them, not to have tried to see how they would get out; it would most likely have been by the same way that they went in; and, if they touched the pollen at all, rather than remove any, they would only leave on it some of their delicate scales, and thus it does not seem possible that their visits can be of any use to the plant.

I was not a little pleased, while watching a plant, to see the *Megachile centuncularis* fly straight into the lip without alighting: it was evidently well used to the road to the sweets, and immediately passed under the column. I covered the flower with my net, when the bee hurried to come out by a side opening, and as I expected I found the hairs of its thorax matted with pollen old and new. This was also the case with the two other bees.

The beetle I found lying on its back under the column, busy sucking the nectar-like exudation on the long hairs which line the base of the lip. Replaced in another flower, it did not hesitate as to what direction it should take; it disappeared under the staminoes and soon came out under one of the anthers, brushing its shoulder against it. When I tried the experiment with a *Megachile*, the result was precisely the same; only the bee was much quicker in its movements. If I obstructed the posterior openings, or if the flower was smaller, the insect began at once to bite and tear with its powerful mandibles, till it had made the hole large enough to pass through. I noticed also that when the temperature was low, the bee was not active enough to effect its exit: in a cool room it remained as if powerless.

On comparing the known guests that are able to fertilise *C. pubescens* and *C. spectabile*, we find naturally the larger ones in the latter species, which has larger flowers and has also no pointed tip to the anther-filament to hold the edge of the lip; it thus allows a larger insect to leave the flower. That tip is also absent in *C. acaule*, whose flowers are rather larger again, and in the odd little *C. arietinum*. The two last named species are remarkable for having the median opening of the lip obstructed, the former by folds of its edge closing together, and the other by abundant white hairs, similar to those that thickly line the base of the lip inside. The object is obviously to compel the guests after their feast to go out under the anther, but it must be exceedingly interesting to witness them, when they enter force their way where there seems to be no way. I do not know that any visitors have been found in these flowers, nor in those of *C. parviflorum*, which seems to differ from *C. pubescens* only by its smaller size and brighter colours. On account of the position of the anthers of *C. acaule*, exactly above the centre of the posterior openings of the lip, the pollen must adhere as a general rule exactly in the middle of the back of the

visitors. Hence the stigmatic surface needs not to be so broad, and such is indeed the case, it being comparatively narrow.

An idea may be formed from these notes which I must now bring to a close, how limited is yet the amount of information on the attractive subject of the fertilisation of Canadian Orchids. Will it not induce many friends of insects and of flowers, if they have not done so before, to watch them carefully as to their relations to each other? If every one would make a note at the time what insects he sees on blossoms of any kind, and communicate his observations, a great deal of interesting and valuable knowledge would thus be collected.

Orchids deserve especial attention, both on account of their wonderful contrivances for cross-fertilisation, and because they are not generally easy to discover nor to observe. Owing to their fondness for damp, shady spots, the days and the hours of day, when insects can visit them are rare, and one will seldom be ready to watch them at the favorable time. Moreover, on account of their absolute need of moisture and cover, they are constantly disappearing before the axe and spade of the settler, as also, precisely on account of their rarity, before the greed of too many of their pretended friends, the plant-collectors. In the vicinity of cities, at least, they rapidly become scarce. Every opportunity should, therefore, be improved, and not only especially for plants of this order, but generally for all.

## HYMENOPTERA ACULEATA.

### ANTS, WASPS AND BEES.

BY W. HAGUE HARRINGTON, OTTAWA.

Our reports contain each year references to, or descriptions of, various Hymenoptera, but no attempt has previously been made to acquaint our readers with the relations that these insects bear to one another, I will therefore endeavour, in the interests of those who have not access to systematic works, or who have not the time to study them, to outline the groups included in the sub order Aculeata, or sting-bearers, the members of which are popularly known as ants, wasps, and bees.

Of these there are nine families represented in Canada,\* which include about two hundred and fifty recorded species.

#### FORMICIDÆ.

The very interesting paper by Mr. G. W. Bowles, in the report published last year, renders it unnecessary for me to give any account of this family. I may, however, state that the species have been very meagrely investigated hitherto by our collectors, so that our knowledge of Canadian ants (as indeed of all our Hymenoptera) is very incomplete. I have myself collected in this neighbourhood alone several genera and species not hitherto recorded, and if entomologists in other parts of this extended country would give attention to these insects, so intelligent in their actions, and so interesting in their habits, it would be found that the number of species is quite large.

#### CHRYSIDIDÆ.

This group is not included by some authors in Aculeata, but is considered to belong to Terebrantia, along with the Ichneumonans, Gall-flies and Saw-flies. Its members are not furnished with stings such as the bees and wasps possess, for they lack the poison glands which enable the latter to inflict such pain. Only about a dozen species are known to occur in Canada. These are all comparatively small insects, the largest being but about the size of the house-fly, and are remarkable for their brilliant metallic colours, in which green predominates. They are active insects, to be seen upon flowers and shrubs, or

\* I have largely adopted as suitable for this paper the classification used by Mr. L. O. Howard in the Standard Natural History now being published.

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running about on old trees searching the holes made by other insects. When captured, many of the species will roll themselves into little balls, by folding the head upon the breast and bending the abdomen under so as to cover it. The abdomen consists apparently of three, four, or (in the male of *Cleptes*) of five segments, thus differing from that of bees and wasps. The missing segments are diminished in size and are retracted within the others so as to form a telescopic sheath for the ovipositor. The Chrysidids are parasitic in their mode of life, chiefly upon bees and wasps, laying their eggs in the nests of various genera. The grubs of some species are known to feed upon the larvæ of their hosts, while others content themselves with devouring the store of nourishment laid by for these, and starving the rightful inhabitants of the cells.

The next five families, Mutillidæ, Scoliadæ, Sapygidæ, Pompilidæ, and Sphegidæ, have been grouped under the title of *Fossorial Hymenoptera*, because the habit of digging or burrowing is characteristic of the greater number.

#### MUTILLIDÆ.

These are ant-like insects, known generally as "Solitary Ants." The females have no wings, but the males are usually furnished with them. Both species and individuals are rare in Canada; only two species are recorded, and a single female of *Methoca bicolor* is the only capture I have made here. Although having much the appearance of ants, they may be recognized by the absence of the knot, or scale, which is found in ants between the thorax and the abdomen.

#### SCOLIADÆ AND SAPYGIDÆ.

Of these families we have also but few representatives; about half-a-dozen species. They are solitary in their habits; the females of some species making deep burrows in the earth in which to deposit their eggs, and a supply of food for the larvæ therefrom. Other species are said to be parasitic on the grubs of beetles, etc., and a few to be inquiline (self invited guests) in the nests of certain wild bees. Our commonest and largest species is *Tiphia inornata*, which is thought by Provencher to feed in the larval stage upon the grubs of *Lachnosterna fusca*.

#### POMPILIDÆ.

This family is more rich in species, for thirty are recorded, and undoubtedly many remain to be discovered, especially in the west. Nearly all these are black insects, sometimes with a bluish tint, or with markings of red, white, or yellow. They are of slender form, with the wings generally clouded, and sometimes very black. The legs are long and frequently spinous, and enable the insects to burrow in the sand with great rapidity; whence they have derived the name of "sand-wasps."

Our species are included in four genera, of which *Pompilus* contains more than half the species. These have the legs furnished with spiny hairs, and construct with ease deep burrows in sand or loose soil, in which they store caterpillars, etc. The sting which they carry, and are quick to employ, is a formidable weapon, but the wound inflicted is not nearly so severe as that of the true wasp. *Pompilus aethiops* is our largest species, measuring sometimes three-quarters of an inch in length, and is of a rich deep black colour; the wings black, with a purplish tinge. *P. biguttatus* is a more common insect; black, with white marks on the abdomen, and sometimes on other parts of the body.

The genus *Priocnemis*, instead of having the posterior tibiæ with spinous hairs, has the outer edge of them toothed, or serrate. In other respects the species are almost undistinguishable from *Pompilus*. In *Agenia* (Fig.

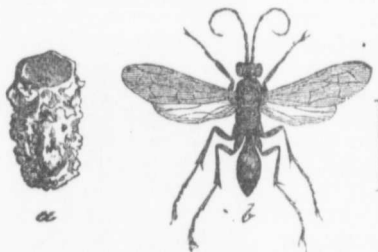


Fig. 3b, nest a.

3b, nest a) and *Ceropales* the legs are unarmed, and, especially in the latter, very long and slender.

## SPHEGIDÆ.

At least one hundred of our species are contained in this family, which is divided into several sub-families, each of which is considered by some writers entitled to rank as an independent family.

The first of these, Larrinae, contains several wasp-like insects of moderate size, and usually black, which are found running and flying about the ground in dry, warm places, searching for the insects with which to provision their burrows. A common species is *Larra quebecensis*, black, with the basal half of the abdomen red, found often on flowers, and which I have seen carrying grasshoppers to its burrows. *L. terminata* is a smaller species, black, with the tip of the abdomen yellowish, and has also been observed by me bearing off young grasshoppers.

The sub-family Spheginae, contains larger insects, long and slender, the base of the abdomen being attenuated and lengthened to form a pedicle connecting it with the thorax. Of the genus *Sphex* five species are recorded, which seem to occur chiefly in western Ontario, as I have not yet been able to capture or observe any in this neighbourhood, and none are recorded by Provencher from Quebec. *Sphex ichneumonea*, one of the species on our lists, it is said "digs rapidly into hard ground, using both jaws and fore legs in the process, and a single female completes two or three burrows, five inches deep, in the course of an afternoon. She preferably provisions her cells with *Orchelimum* and allied forms."

*Pelopæus* contains the well-known insects which construct the oblong mud cells, found, usually side by side in rows, under flat stones in the country, or under window-sills, cornices, etc., in the city. Each of these cells is stored with spiders, etc., to feed the larva which is to develop from the egg deposited in it. In spring the perfect insects emerge from their earthen homes, which are found to be lined with a thin tough cocoon, and they may be seen during the summer collecting earth in damp places with which to build, or catching the insects which they require for their future brood. They are remarkable for the long, slender pedicle by which the oval abdomen is attached to the thorax. *Pelopæus ceruleus* (Fig. 4) is a brilliant blue insect, three-fourths of an inch long, which does much good by disposing of many caterpillars, etc. In the Southern States it has been observed capturing half-grown individuals of the very destructive cotton-worm. *P. cementarius* is somewhat larger, and is

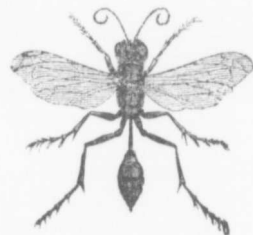


Fig. 4.

black with the legs partly yellow; it provisions its nest largely with spiders.

The genus *Ammophila* also contains species having the first, or first and second, segments of the abdomen elongated and very slender. They construct holes in the earth especially along pathways in sandy fields, where they may be seen flying up and down in abundance. They are instrumental in destroying large numbers of cutworms and other caterpillars, which they may frequently be seen dragging off to the holes burrowed where the soil is loose or sandy, and in each of which are placed several grubs. *Ammophila luctuosa*, (Fig. 5,) is an entirely black species, very common in dry fields in early spring, before other insects have become abundant. The other species usually observed have a portion of the abdomen red. (Fig. 6.)



Fig. 5.

The sub-family Bembecinae contains only three species, of which *Bembex fasciata* is a handsome insect, much resembling the



Fig. 6.

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Fig. 7.

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and flatter, and the yellowish bands on the abdomen are widely interrupted in the middle. It occurs in dry fields, not very abundantly, and constructs in them burrows which are stored with flies and other insects captured in its flight, *B. Monodonta* is a smaller insect, having broad white bands across the abdomen. *Monedula ventralis* is intermediate

in size between the two former species and is more common than either: its markings more resembling those of the first.

The Nyssoninae are insects found during the summer upon flowering plants, and are smaller than those of the preceding sub-families. Nysson is characterized by having the metathorax spinous at the hinder angles. Alyson contains several species of slender insects met with (at least in this locality) most abundantly upon golden-rod, especially when, as is frequently the case, it is badly infested by aphides. Three species of the genus *Gorytes*, (Fig. 7.) occur, which are more wasp-like in appearance



Fig. 7.

and frequent spiraea, golden-rod, etc.

The sub-families, Philanthinae, Pemphredoninae and Crabroninae, contain insects similar in general appearance, having the same habits, and which can conveniently be grouped as regards the Canadian species in one family, as has been done by Provencher, with the title *Crabronidae*.

Its members, sometimes known as 'wood-wasps,' are all small or of moderate size, the largest species—*Crabro singularis*—not being so big as the ordinary wasp. Many of them are quite wasp-like in appearance, their general colour being black with yellow markings, while others have the abdomen either elongated or pedicled. The heads of these insects are usually large in proportion to the remainder of their bodies, especially is this the case in the genus *Crabro*. We have about fifty species divided into about fifteen genera: the typical genus *Crabro* containing nearly two-fifths of the species. They are most frequently met with upon flowers such as golden-rod, etc.

The various species of *Crabro* bore holes in dead wood, or avail themselves of the deserted burrows of other insects, and provision these with dipterous or other insects. Those of *Rhopalum* excavate the pithy stems of elder, etc. The males of *Thryceopus* have the front legs curiously flattened, so as to be of leaf-like structure, and by this peculiarity may be easily distinguished from any other of our Hymenoptera.

#### VESPIDÆ.

This family contains the "true wasps" and our species are grouped in two sub-families, of which the first, Eumeninae, includes those species which are solitary in their habits. Of Eumenes, Fig. 8, *a*, we have only one or two species, black with yellow markings, and distinguished from the following genus by the long pedicle which connects the abdomen to the thorax. They construct curious flask-shaped cells of mud (Fig. 8, *b c*.) on the stems of plants or twigs of trees. *Odynerus* contains at least a dozen species, which differ little, except in size, and which make mud cells in crevices, hollow stones, under stones, etc. *Odynerus capra*, one of the larger species, has been observed by Rev. Mr. Fyles, of Quebec (as stated by him at the annual meeting of the Entomological Society) to attack the larvæ of the currant sawfly (*Nematus ventricosus*). It is to be hoped that this habit will become prevalent among these insects, and that they may take large numbers of the obnoxious grubs to fill their cells.

The "social wasps" are to be found in the sub family Vespinae. Those of the genus *Vespa* are the builders of the large papery structures which the average schoolboy (or

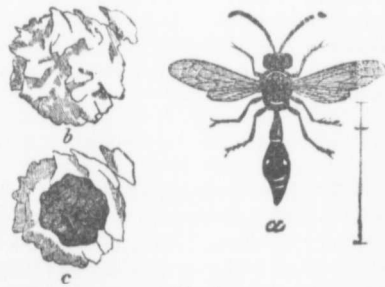


Fig. 8.



Fig. 6.

ever, is broader

other urchin) delights to destroy, regardless of the labor which has been expended in its construction, or of the many lives it contains. They are also the possessors of powerful stings, as many of the said urchins experience and of which I have myself felt the venom on several occasions. The "yellow-jackets" who have a nest hid in a clump of raspberries delight to put to flight those who would pluck the fruit of the vines, and the old wasp who has commenced her home in the woodshed is jealous of intruders. *Vespa maculata*, (Fig. 9,) the white-faced wasp, whose colours are black and white, may very frequently be seen on old palings, boards, dead trees, etc., scraping off with its mandibles the fibres of wood, which it carries off to its nest and uses in its construction.



Fig. 9.

The household of the wasp consists in summer of three sorts of individuals (as in the ants) of which the workers, or sterile females, are the most abundant. The colony is not, however, a perennial institution like an ant-hill, but lasts only for one season. It is founded by an impregnated female, which has managed to survive the winter in some protected crevice, and which, revived by the warmth of spring, comes forth to commence her housekeeping. Building a comb of a few cells, she deposits an egg in each, and when the larvæ are hatched she feeds them carefully with the juices of flowers and animal matter, or with finely masticated morsels of insects such as flies. These larvæ develop finally into workers which assist their mother in enlarging the domicile and in rearing new broods of inmates. The nest grows larger and larger; new coverings being constructed without, and the inner ones demolished to give room for the new rows of cells which are added to the combs. These combs are placed horizontally, suspended one below the other by columns. The cells are constructed mouth downward so that the larvæ have always to stand on their heads, or rather to hang by their tails, seemingly a very awkward and dangerous position in which to spend this period of their existence. The time taken to pass from the egg to the perfect state occupies about a month, and thus there can be several broods in the season. The last one contains males and fertile females, and, as has already been stated, some of the latter survive the winter to be the founders of new colonies. The species, of which there are several, constructing the large nests all belong to the genus *Vespa*.

There is another wasp which constructs a tiny nest of a few cells under flat stones, etc., which belongs to the genus *Polistes*. Its nest is not surrounded by a papery envelope, but is merely attached to the under side of a stone by a short foot-stalk, and it is never enlarged to accommodate a large family. The name of the species is *Polistes pallipes*. (Fig. 10, *a*. wasp, *b*. nest.)

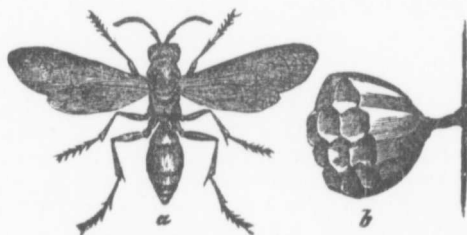


Fig. 10.

#### ANDRENIDÆ.

The insects contained in this family with those of the following one (Apidæ) are by some entomologists grouped in a sub-order, or tribe, to which is given the name *Mellifera*, or Honey-makers. Abbé Provencher has grouped into this family many genera which are sometimes placed with the Apidæ, and includes in that family only the genera which form the sub-family Socialinæ of some authorities. It will suit us very well here to follow the Abbé and the family as by him constituted will be found to contain about twenty-five genera, and over one hundred species.

Its members are commonly known as "Solitary Bees," and differ also from the Apidæ, or "Social Bees" in not having sterile females, or workers. As might be expected, the species vary much in their habits, and in their modes of making provision for their

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crevice is filled. very great, for the honey bee in size part of the abdomen and fringed with

*Osmia* contains the abdomen, but the lustre, and have



offspring. A few of the genera are considered parasitic, utilizing for their own progeny the stores of honey and pollen so laboriously laid up by other species of bees. Such worthless individuals are unprovided with instruments for gathering pollen, whereas those which honestly toil to provide for the securing of their progeny, have brushes of stiff hairs either on the legs or abdomen with which to gather and transport pollen.

The females of *Anthophora* and *Melisodes*, resemble small humble bees, and have stiff brushes on the hind legs for carrying pollen. They construct burrows in the earth in which to deposit their eggs, each of which is placed in a ball of pollen and honey.

The species of *Andrena* are numerous and the females transport their pollen by means of the long hairs which clothe their thighs. They sink shafts in light soils to a depth of a few inches, and at intervals make short side tunnels, each of which forms a cell for the reception of an egg and its store of nourishment. This food is apparently gathered indiscriminately from any flowering plant, even such kinds as sumac and poison-ivy are fully garnered.

*Halictus* also contains a number of small bees which it is difficult to distinguish from the preceding, and which have the same habits almost. Some of the species are very small—the smallest of our bees—and these usually have a semi-metallic lustre. The larger species have bands of silvery hair across the abdomen.

Our most brilliant bees are two species which belong to the genus *Augochlora*. They are of a beautiful golden-green color, and may often be seen entering burrows in dead wood, or may be captured upon the flowers which they visit for honey and pollen. *Agapostemon tricolor* is a closely allied and very pretty insect, easily distinguished by its tri-colored markings of green, yellow and black. There are four or five species of pretty little red bees, considered to be parasitic in their habits, which belong to *Nomada*. *N. americana* has the abdomen entirely red; the others have more or less distinct bands or markings of yellow.



Fig. 11.

The bees belonging to the genus *Megachile* (Fig. 11) *M. brevis* number fifteen to twenty species, and have the very interesting habit of forming the cells of their nest with morsels of leaves. With her long, sharp mandibles the female cuts out, as quickly and perfectly as with a pair of scissors, a portion of the leaf of a rose, maple, locust or other plant, and grasping it with her feet flies off to the hole that she has chosen in some old log or stump. This hole is lined internally with the pieces of leaves, which form a cylinder, and when a sufficient length for a cell has been completed, a ball of honey and pollen containing an egg is deposited and the cell is covered by circular morsels, and another commenced. This process is continued until the hole or crevice is filled. The labour thus performed by these "leaf-cutters" or upholstering bees" is very great, for it requires the clipping and transportation of several hundreds of leaf fragments. The Megachiles are larger than the bees of the preceding genera, and some equal the honey bee in size. They are black with pubescence varying in colour, and on the under part of the abdomen of the female the hairs are stiff and form a brush for the collection of pollen. The males of many of the species have the anterior tarsi (feet), broadly dilated and fringed with long hair, a character which makes them easily distinguishable.

*Osmia* contains also a number of species in which the females have a brush under the abdomen, but the insects have generally a more or less metallic, often greenish or bluish, lustre, and have not the leaf cutting habits of the foregoing genus. They select for nesting

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#### APIDÆ.

This family contains the "social bees;" insects endowed with wonderful habits of industry, and of foresight and care in the rearing of their offspring. It contains only three genera of which the first, *Apathus*, is, I regret to say, apparently unworthy of its high position in the Hymenoptera. Its members toil not to lay up sweet stores in houses built by themselves, but live with their industrious relatives the humble-bees, and are believed to be mere parasites, or lazy mess-mates of their friends. There are several species, each mimicking more or less closely one or other of the species of *Bombus*, and probably infesting the nests of that species. They can, however, be readily distinguished from the humble-bees by the shape of the hinder legs, which lack the basket-like form of those of the latter insects.

Of the genus *Bombus*, there are some thirty species recorded as occurring in Canada, or about one-half of those described from North America. These are the large noisy insects so well-known as "humble" or "bumble" bees, which abound wherever flowering plants are found, and which add not a little life and animation to the outdoor world during summer. The record of their life is similar to that already recorded for the wasp. The hibernating, impregnated female founds in spring a colony which grows during the summer, by the addition of the "workers" reared in the nest, and which cheerfully assist their mother in all the duties of the establishment. The larvæ, however, are fed with a sweet paste of honey and pollen, and instead of dwelling in paper cells occupy waxen ones. The nests of our species are usually placed underground; a favorite locality being the deserted nest of a field-mouse. The comb has not the regularity of structure attained by the honey-bee, being merely a cluster of oval cells, varying in size, and without arrangement of any kind, while the wax of which they are made is of a very inferior quality and dingy appearance. The females and workers have the hinder tibiæ flattened and broad, and surrounded by a fringe of long hairs, so as to form shallow baskets in which they can gather and transport a large quantity of pollen at each trip. As the colony only lasts for one season, no honey is collected beyond that necessary for the nourishment of the larvæ. About mid-summer males and females are reared, in order that the continuance of the race may be provided for, but the males perish after the fecundation of the females, and some of these alone survive the winter.

We have now arrived at the last, and, at least to man, the most important member of the Hymenoptera—the honey-bee, and its productions have been celebrated by poets and other writers of all ages, and the store that it gathers for its nourishment has ever been considered not only a palatable article of food, but also a luxury fit for the table of a king. It would require far more than the few pages allotted to me for this paper to give even a concise history of this truly wonderful insect. Fortunately it is so well known throughout Canada that my readers do not require any description of it, and probably a large number of them have a far more practical knowledge of it than I myself possess. *Apis mellifica*, as it is scientifically known, is not a native of Canada, but has been brought hither from the old world. There are several varieties known to bee-cultivators, which have been received from various countries, as Italy, Palestine, Syria, and Cyprus. Such is the importance placed upon the improvement of bee-stocks, that new breeds are sought for in the most distant lands, with the hope of obtaining additional good qualities, and numerous hybrids between the several kinds have already been produced. The hives, unlike the colonies of humble-bees, contain communities flourishing from year to year, and sending forth new swarms each season, while the surplus stores they garner amount to millions of pounds annually, and form a considerable item in the food supply of mankind.

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## CATOCALÆ.—UNDERWING MOTHS.

BY G. J. BOWLES, MONTREAL.

The Noctuidæ, or night-flying moths form a large division of the order Lepidoptera. Generally speaking, they are clothed in a sober livery of grey or brown, and are therefore not very conspicuous or attractive in their appearance. But on a closer examination, many of them are found to be marked with beautiful patterns in lines and spots, while some are spangled with gold or silver in different ways. There are some genera, however, towards the end of the family, as at present classified by entomologists, which are remarkable on account of their size and the richness and beauty of their markings. In their case nature has departed from her rule, that quiet colours should be characteristic of the Noctuidæ, and has decked them out in gay apparel, as if, even in these night-flying insects, she could not resist the impulse which has spread beauty of colour and form throughout the whole creation.

Chief among these is the genus *Catocala*, commonly called "under wings," and to these moths we wish to draw the attention of our readers.

The *Catocalas* are found both in the old and new worlds, and principally, if not wholly, in temperate regions. Between thirty and forty species inhabit Europe, (four of which occur in Britain, according to Newman,) while those taken in America number more than sixty. These are, so far as known, confined to the North American continent, and have not yet been taken in the West India Islands, with one exception, *Iliia*, which the Rev. C. J. S. Bethune states is found in Jamaica. Canada has more than thirty species, all of which are also found in the United States. Some of these are comparatively abundant, and inhabit large areas, extending as far north as Hudson's Bay; others are comparatively rare, or confined to certain localities. The species with black hind wings are, with two exceptions, absent from the northern parts of the Province of Quebec, but begin to appear in Western Ontario, and are most common in the Western, Middle and Southern States. They seem to require milder climatic conditions than the others, and to represent the less hardy portion of this extensive group of moths.

Although these insects surpass the rest of the Noctuidæ in average size, they are never very numerous, and therefore their larvæ are not destructive to vegetation in any appreciable degree. The caterpillars feed on the leaves of various trees, such as oak, poplar and willow. They are of peculiar shape, being long and narrow, flattened on the under surface, and convex above, and bearing a row of pointed fleshy appendages on each side, where the convex and flattened surfaces meet. They are also striped and marked in various ways, according to the species, and all have flattened heads, which in some species are bilobed. In the larva state, they are very active, and can walk quite rapidly. This rapid motion gives them almost a geometrid appearance, which, in some species, is assisted by the fact that the larva has only twelve feet instead of sixteen, the usual number allotted to the Noctuidæ. The caterpillars of the larger species are from two to three inches long when full grown.

When it ceases to feed, the larva spins a thin, gauzy cocoon, and changes into a brown pupa or chrysalis, covered with a purplish bloom like that of a plum. The perfect insects all emerge during July, August and September, some species appearing earlier than others, but it is probable that all pass the winter in the egg state, hatching out at the same time in spring as the leaves of their food plant appear.

The moths are strong, active insects, with good powers of flight. Though night flyers, and therefore having the habit, common to the Noctuidæ, of resting in the daytime as if asleep, they are very easily disturbed. In fact some species seem to be always wide awake, so that they can hardly be approached during daylight without taking to flight. As evening approaches, the moths gradually arouse themselves, and at this time may sometimes be seen flitting around the trees in gardens or on the outskirts of the woods. A *Catocala*, thus seen flying, is a very pretty object, particularly one of the red-winged species. With its richly-coloured hind wings, and the contrasted grey fore wings, all in rapid motion, it is indeed a "thing of beauty." Their proper time of flight, how-

ever, is after dark, when they rove about in pursuit of their mates, or in quest of food, for they have long tongues, and are very fond of sweets.

Though these moths are large, and not generally scarce, the collector has considerable difficulty in finding them. In the daytime, they usually select resting places where their colours will harmonize with those of their surroundings. No doubt this is to aid in their concealment from their enemies. When at rest their brightly-coloured hind wings are entirely concealed by the fore wings, and nothing is to be seen but a large grey triangle, mottled with black or brown. The trunks of large trees, and the corners and copings of unpainted fences, are favorite places with them, and if the rough bark of the trees has deep crevices they are fond of hiding themselves there, so as to increase their security. Thus the collector has need of a sharp eye to detect the moths, so well are they protected by their colours and the exercise of instinct.

The best way, however, to capture these insects, is by the process known to Lepidopterists as "sugaring." They cannot resist coming to the sweet feast provided by the deceitful collector, and pay the penalty in contributing many specimens, rich and sometimes rare to his cabinet.

Another mode, described by Professor French, of Carbondale, Illinois, (Can. Ent., 1880, p. 241,) is to whip the trees in the afternoons between one and four o'clock, disturbing the moths in their *siesta* and catching them in nets. In the instance reported by that gentleman this operation was remarkably successful.

In order to induce our readers to take some further interest in these lovely insects we append a list of the Canadian species, so far as known, with a description of each, which will enable the student to identify many, if not all the moths. As the genus is so large, it is useful to divide it into sections, grouping the moths in accordance with the colours of their hind wings. In this arrangement the Canadian species stand as follows:

#### GENUS CATOCALA, SCHRANK.

##### Section I.—Hindwings black, without bands.

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|-------------------------------|-------------------------------|
| 1. <i>Epione</i> , Drury.     | 4. <i>Insolabilis</i> , Guen. |
| 2. <i>Desperata</i> , Guenee. | 5. <i>Residua</i> , Grote.    |
| 3. <i>Retecta</i> , Grote.    |                               |

##### Section II.—Hindwings black and white.

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| 6. <i>Relicta</i> , Walker. |  |
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##### Section III.—Hindwings black and red.

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| 7. <i>Amatrix</i> , Hubner.   | 14. <i>Semirelicta</i> , Grote.   |
| 8. <i>Cara</i> , Guen.        | 15. <i>Faustina</i> , Strecker.   |
| 9. <i>Concumbens</i> , Guen.  | 16. <i>Parta</i> , Guen.          |
| 10. <i>Meskei</i> , Grote.    | 17. <i>Coccinata</i> , Grote.     |
| 11. <i>Unijuga</i> , Walk.    | 18. <i>Ultronia</i> , Hubner.     |
| 12. <i>Beaniana</i> , Grote.  | 19. <i>Iliia</i> , Cramer.        |
| 13. <i>Briseis</i> , Edwards. | Also variety <i>Uxor</i> , Grote. |

##### Section IV.—Hindwings black and yellow.

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| 20. <i>Cerogama</i> , Guen.  | 26. <i>Antinympa</i> , Hubner.                                      |
| 21. <i>Neogama</i> , Ab. and Smith.<br>Also variety <i>Communis</i> , Grote. | 27. <i>Clintonii</i> , Grote.                                       |
| 22. <i>Subnata</i> , Grote.  | 28. <i>Polygama</i> , Guen.   |
| 23. <i>Piatrix</i> , Grote.  | 29. <i>Cratagi</i> , Saunders.                                      |
| 24. <i>Palæogama</i> , Guen.<br>Also variety <i>Phalanga</i> , Grote.        | 30. <i>Similis</i> , Edw. (formula G. and R.)                       |
| 25. <i>Habilis</i> , Grote.  | 31. <i>Fratercula</i> , Gr. and Rob.                                |
|  | 32. <i>Amica</i> , Hubner.<br>Also variety <i>Lineella</i> , Grote. |

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## Section I.

Those comprised in the first section are of large size, and have hind wings of dark grey, shading into black, giving them a chaste and quiet beauty which is very pleasing. The grey fore wings are marked with black and white in a pattern differently arranged for each species, and the hind wings are generally fringed with white.

1. *Epione* is a rare species having only been captured in Canada, so far, at Hamilton, by the late Mr. Murray. Fore wings dark grey, crossed by the usual lines in black. Outside the transverse posterior zigzag line is a brown band (in well-marked specimens) about one-tenth of an inch wide, which follows its outline, and beyond this is a greyish white band of similar shape. The wing outside of these bands is somewhat lighter in colour than the inner two-thirds. Hind wings brown at base, shading into deep black, and with a pure white fringe. Head and body dark grey, expands two to two and three-quarter inches.

2. *Desperata*.—Forewings light grey with black lines and dashes, one of which extends from the base as far as the subreniform spot. The reniform spot is large, oval, and surrounded by a double line. Hind wings brownish grey at base, shading into deep black, fringe white. Expands three inches. Found at Montreal and London. Larva feeds on various species of oak. This is probably the *C. vidua* of the Rev. C. J. S. Bethune's paper, published in the *Canadian Journal*, 1863 and there stated to be taken at Toronto.

3. *Retecta*.—Closely related to *desperata*, but differs in the ground colour of fore wings, being brighter and less blueish, the black shades are sharper, and the white fringe on secondaries is wider. Its size is also smaller. Found at London, rare.

4. *Insolabilis*.—A large species, darker in colour than the two preceding, and having a dark grey instead of a white fringe to its black hind wings. A dark shade on the interior edge of the fore wings also helps to distinguish this species. Found at London. Not common. Expands about three inches.

5. *Residua* is a smaller moth than *insolabilis*, but closely resembles it in colour and markings. The dark shade on interior edge of fore wings is absent. Expands two and a-half inches. Found at London and Hamilton.

## Section II.

6. *Relicta*, the only species in Section II, is a very beautiful insect,—the Queen of the Catocalas,—though bearing a somewhat doleful name. *Relicta* means *forsaken*, and was perhaps given to the moth by Walker on account of its colours, which are those of a widow's mourning,—black and white. Many of the names of the Catocalas are female names, or relate to love and marriage, and this one is therefore not inappropriate. Though not common, it is found from Quebec to London, and probably occurs all over the Dominion, south of the colder regions. It expands about three inches, and the larva feeds on poplar. The white curved band on the hind wings, and the white ground colour of the primaries, crossed with black lines, so fully distinguish this moth from all other Canadian species that a detailed description is not necessary.

## Section III.

Section III. includes some of the largest and most striking of the Catocalas.

7. *Amatrix*, a species expanding over three inches, with brownish grey fore wings, marked with the usual lines. Hind wings rosy red, with a wide black band on the margin, much wider in front, also a black inner band, which does not quite reach the interior margin of the wing. Though found from Nova Scotia to London, it is not common anywhere. The caterpillar feeds on Lombardy and other poplars.

8. *Cara*.—One of the most beautiful of the genus. A large and robust insect, with fore wings of a rich dark brown, with a few black lines, and markings of lighter brown.

Hind wings of a brilliant rosy pink, with a wide black marginal band, and an inner one of the same colour, also a blackish shade extending from the base along the interior margin. Expands three to three and a half inches. Found at London and other parts of western Ontario. Larva feeds on willow.

9. *Concumbens*.—A very beautiful moth, much smaller than *Cara*, but somewhat resembling it. Fore wings light greyish-brown, marked with black crosslines and grey shades; hind wings bright rosy red with a wide white fringe, and the usual black bands, the inner one of which does not reach the interior margin of the wing. The moth is found from Quebec to London, and is very common at Montreal. Expands about two and a-half inches. Larva feeds on willow. This species is closely related to *Catocala pacta* of Europe. It is somewhat larger, and the colour of the abdomen is different, being light brown, while that of *pacta* is rosy red. Some specimens, however, of *Concumbens* taken at Montreal have had this rosy tinge on the abdomen.

10. *Meskei*.—A large species, closely resembling *unijuga* in size and markings, but somewhat lighter in the grey of the fore wings, and the lines less distinct. Found at London, also at Montreal (Hy. Edwards). Larva feeds on poplar.

11. *Unijuga*.—A widely diffused species, being found at Hudson's Bay, and in all parts of Quebec and Ontario. Fore wings dark grey, with the usual black lines, which are all doubled. Reniform spot large, sometimes black, a whitish spot on the inner side. Subreniform whitish. Hind wings dark red, marginal band irregular on inner side. Inner black band not reaching to interior margin. Fringe white. Expands two and a-half to three inches. Larva feeds on poplar.

12. *Beaniana*.—Identified as occurring at Montreal by Mr. Henry Edwards of N.Y. somewhat smaller than *unijuga*, but much resembling it. Fore wings shorter and broader, and more of a bluish grey. Hind wings rosy red, outer black band as in *unijuga*, but somewhat toothed on the nervures on the inner side. Inner band ending in a point curved up towards base of wing, but not touching interior margin. Rare.

13. *Briseis*.—A fine species and of large size, fore wings very dark grey with black lines, and a whitish irregular band extending nearly across the apical third of the wings. The subreniform spot and a space above it are also whitish. Hind wings a rich deep red, with usual black bands, the inner one of which hardly reaches the interior margin. Expands two and a-half to three inches. Found from Montreal to London. Not uncommon.

14. *Semirelictia*.—Fore wings light grey, crossed by black zigzag lines, the teeth of the transverse posterior line not at all prominent. Subreniform spot whitish and surrounded by a heavy dark line, a whitish space above it. Inner black line on hind wings almost straight, slightly hooked at the end, which does not reach interior margin. Expands two and a half to three inches. Found at Montreal. Rare.

15. *Faustina*.—Primaries bluish grey, powdered with brown, lines and bands well defined. Subreniform spot white, above this and beside the reniform spot is a white space. Hind wings scarlet, outer band wide on anterior margin, narrowing to a point on interior. Inner band angulated at about half way, and not reaching to interior margin of wing. Expands about two and a half inches. Found at London.

16. *Parta*.—A large and handsome moth, easily distinguished by the light grey fore wings, the reniform spot surrounded by a double black line and having a large whitish spot on the inner side, below which is the large subreniform. There are also whitish spots on the apical third of the wings, and a black dash extending from the base to the apex, but interrupted in the middle. The hind wings are light red, fringes white, outer black band rather wavy on the inner side, inner black band narrow and regularly curved, but not reaching to interior margin of wing. This species is widely diffused, being found at Hudson's Bay and all over the Dominion. It is the commonest species at Quebec, and seems to be one of the northern representatives of the genus. Expands about three inches. Larva feeds on willow.

17. *Coccinata*.—Fore wings light grey with a bluish shade on the interior margin.

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and the usual transverse lines. Reniform spot distinct, subreniform oval, a light brown spot just beyond the transverse posterior line, opposite the reniform spot. Hind wings dark crimson, with the usual bands, the inner one angulated at about halfway. Expands two and a half inches. Taken at Montreal and London. Rare. Larva feeds on oak.

18. *Ultronia*.—Fore wings a rich dark brown along inner margin and below apex, a patch at apex, light brown, rest of wings hoary grey or grey brown, transverse lines indistinct. (See Fig. 12.) Hind wings dark crimson, inner black band irregular in breadth, and reaching interior margin. A very handsome species, expanding about two and a quarter inches. Larva feeds on plum. Found from Quebec to London.

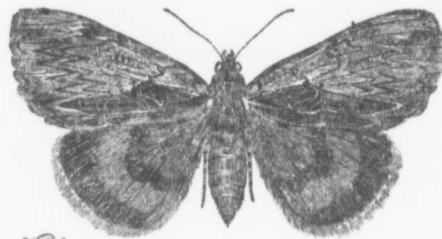


Fig. 12

19. *Ilia*.—One of the most beautiful of the genus. Fore wings dark grey, clouded with black, brown and whitish. Reniform spot very distinct, white with a brown centre, the subreniform square and whitish. Hind wings dark red, marginal black band, wide at anterior, and wavy near interior margin, inner band twice constricted and ending in a point near inner margin of wing, base of wing with long brown hairs. Found from Montreal to London. Larva feeds on oak. Expands three to three and a half inches.

## Section IV.

20. *Cerogama*.—Fore wings light grey, mottled with brown of various shades, transverse lines brown. Hind wings yellow, the yellow space between the two black bands being of the same width throughout. Basal third of wing covered with long brownish hairs. Expands about three inches. Found from Montreal to London, but not generally common.

21. *Neogama*.—Primaries grey and resembling in their colour and markings the preceding species. The hind wings, however, are very different, the yellow being darker and the space between the black bands irregular in outline. Expands about three inches. Found from Montreal to London. Rather common.

The variety *Communis* of this species is somewhat darker in colour, the fore wings have more brown, and the markings are not so distinct, while the ground colour of the hind wings is a dusky buff. It has also been found at Montreal and London.

22. *Subnata*.—This is a fine species, closely allied to *neogama*, but may be distinguished by its larger size, the brighter yellow of the hind wings, and the greater distinctness of the markings on the fore wings. There is a black dash at base of wings, reaching to subreniform spot, which is absent in *neogama*. The subreniform spot is also open, i.e., formed by the bending inwards of the transverse posterior line. In *neogama* it is closed. Expands three and one quarter to three and one half inches. Found at Montreal, also at London.

23. *Piatrix*.—Primaries brown, varied with darker shades, and with black transverse lines. Secondaries dark yellow, base clothed with long brownish hair. Inner black band reaches to interior margin. This species resembles the preceding, but expands only from two and one half to three inches. Found in Ontario, locality not given.

24. *Palæogama*.—Fore wings dark brownish grey, reniform spot dark coloured. Transverse lines indistinct, except the basal line. Hind wings dark buff, outer band wavy near internal margin, inner band much constricted about the middle, and wavy near internal margin. Base of wings clothed with long brown hair. Found at London, where its variety *phalanga* is also taken. Expands two and a half to three inches.

25. *Habilis*.—Fore wings dark grey, with narrow black transverse lines. Hind wings dark buff, space between the black bands narrow and wavy near internal margin. Inner band ends in a point. Base of wings clothed with dark brown hairs. Very like

the preceding species. Expands two and a half to three inches. Found at Montreal and London, but rare.

26. *Antinympha*.—A small species, with almost black fore wings, deep black transverse lines, and the reniform and subreniform spots generally greyish. Hind wings bright yellow, inner black band reaching to internal margin, which is generally tinged with brown towards the base of the wing. Expands one and three quarter to two inches. Found from Montreal to London, not common.

27. *Clintonii*.—Fore wings very pale grey, tinged in centre and on exterior and interior margins with bluish, transverse lines, narrow. A black basal longitudinal line. Hind wings yellow, marginal band not extending to interior margin, sometimes interrupted, and ending in a detached black spot. Inner band narrow in the middle, and not extending to internal margin of wing. Taken at London. Expands two inches.

28. *Polygama*.—Fore wings brownish grey, basal third and interior margin darker, also the subterminal space, centre of wing pale brown. Transverse lines black. Reniform spot dark, subreniform light grey. Hind wings dark yellow, inner black band extending to inner margin, and also sending up a straight branch to base of wing, parallel to inner margin. Expands one and a half inches. Found from Quebec to London. Larva feeds on thorn.

29. *Cratægi*.—A species which much resembles *polygama*. The subreniform spot, however, is connected with and very near the transverse posterior line, which is narrow, and has the lower tooth very small. The brown filling of the subterminal space is absent or very pale. The larva differs considerably, the most prominent and valuable point of distinction being found on the ninth segment, on which *polygama* has a slightly raised fold, while *cratægi* has a distinct thick fleshy horn. Found at London and described by Mr. Saunders in Can. Ent., 1876. p. 72.

30. *Similis*, (*formula* Gr. and Rob.)—Fore wings dark brown, with the part outside of the transverse posterior line, (which is but little angulated,) of a lighter shade, and crossed by two brown zigzag lines. Reniform spot bluish, also an oval spot at base of wing. Hind wings yellow, outer black band interrupted and ending in a spot on interior margin, inner line extends across wing, a blackish shade from base towards this line. Found at Montreal and London. Expands about one and a half inches.

31. *Fratercula*.—Primaries white, tinged and powdered with brown, transverse lines distinct. A brown shade extends diagonally across middle of wing, ending at transverse posterior line, which has *only one large tooth*. Hind wings yellow, outer black band ends abruptly some distance from interior margin, a large black spot on anal angle. Inner band narrow, irregular in shape, and curved upward near internal margin. Found in Ontario, locality not given. Expands one and three quarter inches. Larva feeds on oak.

35. *Amica*.—A small species. Fore wings grey, the outer third of a darker shade. A whitish band crosses the wing, with the subreniform spot on its outer edge, and there is a large whitish patch within the transverse posterior line, near the costa or front edge of the wing. Transverse lines black and distinct. Hind wings bright yellow, marginal band wide, but extending only half way to interior margin, and truncated at the end. A small black spot at anal angle. The inner outline of the band is almost a right angle. *No inner black band*. Expands one and a half inches. Found at London and other localities in Western Ontario. This species is subject to a good deal of variation. One of the varieties, *lineella*, is also taken at London. Its fore wings differ "by the darker shades being gathered along the lines, giving the insect a distinct appearance as compared with the type, while the ground colour is powdered with greenish grey." (Grote, *Papilio* ii. 9.) The hind wings are exactly similar in both type and variety. Larva feeds on oak.

In addition to the foregoing thirty-two species, the following are included in the published list of the Toronto Natural History Society: *viduata*, Guen, *obscura*, Strk., *Levettei*, Grote, *junctura*, Walker, *Aholibah*, Strk., *innubens*, Guen, and var *scintillans*, G. and R., *celebs*, Grote, *serena*, Ed., *amasia*, A. and S., *præclara*, G. and R., *grynea*, Cramer, *gracilis*, Ed. Want of space, however, precludes us from describing these species which, no doubt, are of rare occurrence in Canada.