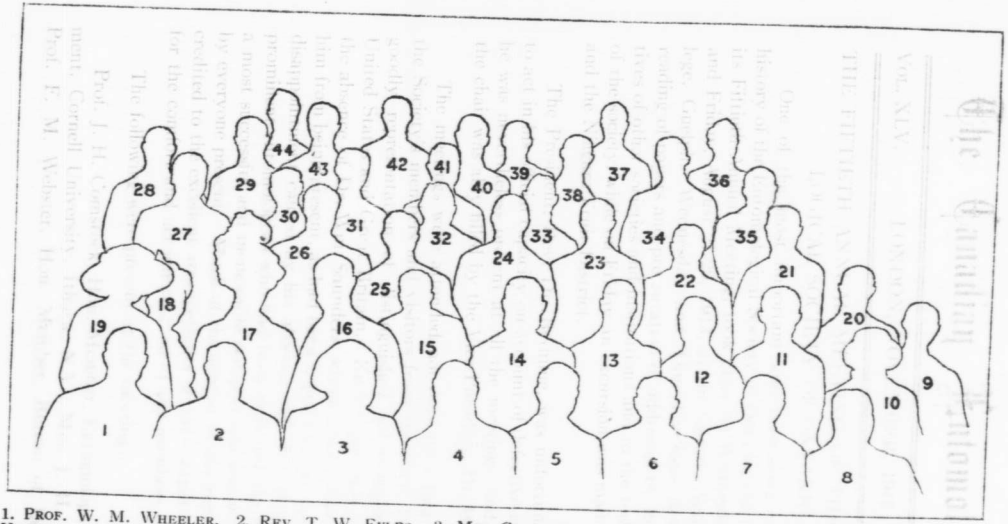
ENTOMOLOGICAL SOCIETY OF ONTARIO—FIFTIETH ANNUAL MEETING.



1. Prof. W. M. Wheeler. 2. Rev. T. W. Fyles. 3. Mrs. Comstock. 4. Rev. Prof. C. J. S. Bethune. 5. Dr. C. G. Hewitt. 6. Prof. J. H. Comstock. 7. Prof. F. M. Webster. 8. Pres. G. C. Creelman. 9. Prof. T. D. Jarvis. 10. Mrs. Jarvis. 11. Dr. E. P. Felt. 12. Prof. P. J. Parrott. 13. J. F. Brimley. 14. J. D. Evans. 15. G. Meade-Waldo. 16. H. H. Lyman. 17. Mrs. Lyman. 18. Miss Bethune. 19. Mrs. C. G. Hewitt. 20. A. Gibson. 21. F. W. L. Sladen. 22. Dr. R. S. MacDougall. 23. Prof. E. M. Walker. 24. Prof. W. Lochhead. 25. Prof. J. Dearness. 26. Mr. W. E. Saunders. 27. Dr. A. Cosens. 28. Mr. J. J. DeVyver. 29. H. Curran. 30. L. Caesar. 31. R. S. Hamilton. 32. J. C. Chapais. 33. C. E. Petch. 34. R. C. Treherne. 35. Prof. T. J. Headlee. 36. W. A. Ross. 37. A. W. Baker. 38. J. D. Tothill. 39. L. S. McLaine. 40. G. J. Spencer. 41. W. A. Clemens. 42. J. F. Hudson. 43. A. Burrows. 44. G. E Sanders

The Canadian Entomologist.

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THE FIFTIETH ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

One of the most important and interesting events in the history of the Entomological Society of Ontario, the celebration of its Fiftieth Annual Meeting, took place on Wednesday, Thursday and Friday, August 27-29, 1913, at the Ontario Agricultural College, Guelph. Wednesday and Thursday were devoted to the reading of papers and presentation of addresses by the representatives of other societies and institutions and to the routine business of the society, while on Friday an excursion was made to Grimsby and the Niagara Fruit District.

The President, Rev. Dr. Bethune, was unfortunately unable to act in his official capacity on account of defective eye-sight, but he was nevertheless present at all the meetings, and his place in the chair was ably filled by the Vice-President, Dr. Hewitt.

The meetings were attended not only by a large number of the Society's members and visitors from the town, but also by a goodly representation of distinguished entomologists from the United States and Great Britain. Keen regret was felt by all in the absence of Dr. Wm. Saunders, whose serious illness prevented him from being present, as had been hoped for, but, apart from the disappointment caused by his absence and that of several other prominent entomologists who had been expected, the meeting was a most successful and memorable occasion and was much enjoyed by everyone present. Much of the success of the meeting is to be credited to the excellent arrangements of the committee in charge for the comfort and accommodation of the members and visitors.

The following were present at the meeting:

Prof. J. H. Comstock, Hon. Member, Entomological Department, Cornell University, Ithaca, N.Y.; Mrs. J. H. Comstock; Prof. F. M. Webster, Hon. Member, Bureau of Entomology,

Washington, D.C.; Dr. E. P. Felt, Hon. Member, State Entomologist, Albany, N.Y.; Dr. R. Stewart MacDougall, University of Edinburgh; Mr. Geoffrey Meade-Waldo, British Museum, London, Eng.; Prof. W. M. Wheeler, Harvard University, Cambridge, Mass; Prof. T. J. Headlee, State Entomologist, New Brunswick, N.J.; Prof. A. D. MacGillivray, Urbana, Ill.; Prof. P. J. Parrott, Geneva, N.Y.; Prof. J. J. de Vyver, Entomological Society of N.Y.; Mr. W. A. Clemens, Ithaca, N.Y.; Dr. C. Gordon Hewitt, Dominion Entomologist, Ottawa; Mrs. C. Gordon Hewitt; The Rev. T. W. Fyles, D.C.L., Ottawa; Mr. and Mrs. Henry H. Lyman, Montreal; Prof. W. Lochhead, MacDonald College, P. Q.; Mr. J. C. Chapais, St. Denis (en bas), Quebec; Mr. John D. Evans, Trenton; Ontario ; Mr. F. J. A. Morris, Peterboro ; Dr. E. M. Walker, University of Toronto, Toronto; Mr. J. B. Williams, University Museum, Toronto; Dr. A. Cosens, Parkdale Collegiate Institute, Toronto; Mr. R. S. Hamilton, Galt; Prof. J. Dearness, London, Ont.; Mr. J. F. Brimley, Grimsby, Ont.; Messrs. Arthur Gibson and F. W. L. Sladen, Division of Entomology, Ottawa; the following Field Agents of the Dominion D'vision of Entomology: Messrs. Sanders, Tothill, Petch, Ross, Hudson, McLaine and R. C. Treherne, Vancouver, B.C.

The Ontario Agricultural College was represented by the following: President Creelman, Prof. C. A. Zavitz, Prof. C. J. S. Bethune, Prof. T. D. Jarvis, Prof. Hutt and Prof. Crow; Mr. L. Caesar, Mr. A. W. Baker, Dr. R. E. Stone, Prof. E. J. Zavitz, Mr. Wright, Mr. G. J. Spencer; Messrs. Burrows, Curran, Good, Hart and others.

On Wednesday evening a meeting of the Council was held in the Biological Lecture Room, at which, among other matters, certain proposed changes in the constitution of the Society were discussed. These changes, which were afterwards adopted at the General Meeting, will be given in full in the December number.

In the afternoon the members and delegates met in the Massey Hall Auditorium, the proceedings commencing with an address of welcome by President Creelman of the College, which was delivered in his usual genial manner and vigorous style. Congratu-

latory addresses were then presented by the following representatives of other societies and institutions:

Prof. E. M. Walker, University of Toronto; Prof. Wm. Lochhead, University of McGill; Dr. C. Gordon Hewitt, University of Manchester, Royal Society of Canada, Academy of National Sciences of Philadelphia and the Canadian Department of Agriculture; Dr. R. Stewart MacDougall, University of Edinburgh and Imperial Bureau of Entomology; Prof. W. M. Wheeler, Harvard University and Boston Society of Natural History; Prof. J. H. Comstock, Cornell University and the Entomological Society of London; Prof. A. D. MacGillivray, Entomological Society of America; Prof. P. J. Parrott, American Association of Economic Entomologists; Dr. E. P. Felt, New York Entomological Society; Prof. F. M. Webster, Entomological Society of Washington and the Bureau of Entomology, U. S. Department Agriculture; Mr. Arthur Gibson, Ottawa Field Naturalists' Club; Mr. J. C. Chapais, Quebec Society for the Protection of Plants; Mr. R. C. Treherne, Entomological Society of British Columbia; Mr. A. F. Winn, Montreal Branch, Ent. Society Ont.; Dr. A. Cosens, Toronto Branch, Ent. Soc. Ont.; Mr. Geoffrey Meade-Waldo, British Museum, Natural History Department, London, England.

A message of congratulation from Dr. William Saunders, who was too ill to be present, was conveyed to the Society by his son, Mr. W. E. Saunders. It was prefaced by a few remarks of appreciation by the Chairman.

Letters of congratulation were also read from the following:

The Imperial Academy of Natural Sciences, St. Petersburg, Russia (by cable); The Vice-Chancellor of the University of Oxford; The Vice-Chancellor of the University of Cambridge; The President, Laval University, Que.; Dr. Walther Horn, Director of the German Entomological Museum, Berlin, Germany; J. P. Moore, Secretary of the Academy of Natural Sciences of Philadelphia; Geo. A. Dean, Kansas State Agricultural College, Manhattan, Kansas; E. Baynes Reed, Dominion Meteorological Station, Victoria, B. C.; N. H. Cowdry, Esq., Chicago; Dr. L. O. Howard, Bureau of Entomology, Washington, D. C.; The University of Chicago, Chicago, Ill.; The Trustees of the British Museum (Na-

tural History), London, Eng.; A. Ross, Sec. Natural History Soc. of Glasgow, Glasgow, Scotland; Guy A. Marshall, Imperial Bureau of Entomology, London, Eng.; Geo. Francis Dow, Secretary, Essex Institute, Salem, Mass.; State Commission of Horticulture, Sacramento, Cal.; Prof. T. D. A. Cockerell, Boulder, Col.; Prof. Harrison Garman, Lexington, Ky.; Prof. H. F. Wickham, University of Iowa, Iowa City.

Letters expressing regret at their inability to attend the meeting or to send a representative were received from the following: Mr. E. T. Cresson, American Entomological Society, Philadelphia; S. A. Rohwer, Secretary, The Entomological Society of Washington, Washington, D.C.; Prof. H. F. Wickham, State University of Iowa, Iowa City; Prof. Francis John Lewis, Edmonton, Alta, representing the Linnean Society of London, Eng.; Stanley Edwards, Hon. Secretary, South London Entomological and Natural History Society, London, Eng.; Dr. Walcott, Secretary, Smithsonian Institution and the United States National Museum, Washington, D.C.; Louisiana State University, Baton Rouge, La.; The Central Museum, Brooklyn, N.Y.; The Director of the Missouri Botanical Garden, St. Louis, Mo.; Professor V. Kellogg, Leland Stanford University, California; President W. O. Thompson, Ohio State University, Columbus, O.; President Stephen A. Forbes, Director, Ill. State Laboratory of Natural History, Urbana, Ill.; President Robert J. Aley, University of Maine, Orono, Maine; Yale University, New Haven, Conn.; F. J. Skiff, Director, Field Museum of Natural History, Chicago; Dr. L. O. Howard, Director Bureau of Entomology, Washington, D.C.; Professor R. Matheson, Agricultural College, Truro, N.S.; Mr. A. F. Burgess, Secretary American Association of Economic Entomologists, Melrose Highlands, Mass.; Hon. Jas. S. Duff, Minister of Agriculture for Ontario, Toronto; Mr. W. Bert Roadhouse, Deputy Minister of Agriculture for Ontario, Toronto; Dr. C. C. James, Ex-Deputy Minister of Agriculture for Ontario, Toronto; Mr. C. E. Grant, Orillia, Ont.; John Bland, Esq., Secretary, Mo. State Board of Horticulture, Columbia, Mo.; Prof. A. L. Melander, State College of Washington, Pullman, Wash.; The President, University of Montana, Missoula, Montana; Prof. Geo. A. Dean, Kansas State Agricultural College,

Manhattan, Kansas; Joseph H. Kastle, Director, Kentucky Agricultural Experiment Station, Lexington, Ky.; E. Davenport, Director, University of Illinois, Champaign, Ill.; Geo. F. Dow, Secretary, Essex Institute, Salem, Mass.; W. W. Atwood, Secretary Chicago Academy of Sciences, Chicago, Ill.; Harry Piers, Secretary N. S. Institute of Sciences, Halifax; A. F. Winn, Secretary, Montreal Branch of the Entomological Society of Ontario, Montreal; Prof. H. Garman, Agricultural Experiment Station, Lexington, Ky.; Prof. J. G. Needham, Cornell University, Ithaca, N. Y.

The evening was marked by one of the most enjoyable features of the meeting—a reception given to the members by President and Mrs. Creelman at their residence.

On Thursday morning a business meeting was held in the Biological Lecture Room, at which the officers for the ensuing year were elected and several matters of interest to the members were discussed. Of these reference has already been made to the revised constitution of the Society. Among other matters, a resolution was passed recommending that the various entomological societies be properly represented at the International Congress of Entomology. The Rev. Dr. T. W. Fyles was elected a life member of the Society. Mr. J. M. Swaine and Dr. E. M. Walker were appointed to represent the Entomological Society of Ontario on the American Committee of Nomenclature. It was decided to hold the next annual meeting at Toronto, the date to be chosen on a later occasion.

The remainder of the day's session was occupied by the reading of addresses and papers, commencing with the Presidential Address by Dr. Bethune, an extremely interesting review of the Society's early history. An abstract of this address is given below, together with the other papers presented.

The feature of the evening meeting was a most interesting and instructive address on Ants by Prof. W. M. Wheeler, an abstract of which is also given below. The lantern slides, with which the lecture was richly illustrated, were of quite exceptional excellence and beauty.

Address of President.

The President, Dr. Bethune, stated that, owing to defective eye-sight, he was unable to prepare a formal written address and

would, therefore, endeavour to give some account of the origin of the Society and the proceedings that led to its formation.

When a student at Trinity College, Toronto, he began the collection and study of insects. At that time there were no available books on the subject. The first work that gave him any assistance in naming specimens was Gosse's "Canadian Naturalist," a delightful work giving an account of observations made in various departments of natural history during each month of the year in the eastern townships of the Province of Quebec. In the Canadian Journal there were published excellent short descriptions of the more conspicuous beetles found in the neighbourhood of Toronto by Wm. Couper, a printer by trade. These were supplemented by lists furnished by Prof. Croft, of the University of Toronto. Kirby and Spence's "Entomology" and Westwood's "Modern Classification of Insects" were published about that time and afforded the first scientific aids to the knowledge of insects. Through the kindness of Prof. Croft, the speaker had access to the library of the University of Toronto, which contained several rare works on entomology. He was also permitted to consult the books in the library of Parliament, which, at that time, was located in Toronto. In these libraries he spent much of his leisure time in laboriously transcribing descriptions of Canadian insects, which, for the most part, had to be translated from Latin and French, and also in making copies of illustrations. These difficulties can hardly be realized by students at the present day who have such an abundance of literature upon every department of natural history. Such works as Comstock's "Manual for the Study of Insects" and Mrs. Comstock's "How to Know the Butterflies" would, at that time, have been treasures indeed. However, there is no doubt that the difficulties encountered helped one to build upon a sound foundation and to acquire a more complete knowledge than could be attained by attempting to hastily read a superabundance of publications.

At the suggestion of Prof. Croft, the speaker made the acquaintance of Mr. Wm. Saunders, of London, who carried on at the time the business of chemist and druggist on a moderate scale. The acquaintance thus formed soon ripened into a mutual friendship and esteem which has continued unbroken to the present time.

In the Canadian Naturalist for June 1862 there appeared a list of persons residing in Canada, all interested in the collection and study of insects, which contained no less than thirty-six names. This was prepared by the speaker, with the assistance of Mr. Saunders. It was then proposed that a meeting should be held for the purpose of bringing together as many as possible of those interested, and to form some kind of club or society which would be of general benefit to those concerned. The result of this publication was the holding of a meeting in Toronto at the residence of Prof. Croft in September, 1862. As there were only ten persons present, it was thought inadvisable to form a society at that time, but a draft of a constitution was drawn up and it was decided to hold another meeting during the coming year. On the 16th of April, 1863, a meeting was held in the library of the Canadian Institute and the formation of the Entomological Society of Canada was then decided upon and its constitution drawn up and adopted. The attendance was small, but several who were unable to be present had given in their adhesion to the movement. Dr. Henry Croft, Professor of Chemistry in the University of Toronto, was elected President; Mr. Saunders, of London, Secretary-Treasurer, and the Rev. Jas. Hubbert, Curator. The others present were: The Rev. Wm. Hincks, Professor of Botany and Zoology at the University of Toronto; Dr. Sangster, Principal of the Normal School, Toronto; Dr. Beverley R. Morris, an Englishman who not long after returned to England and there became editor of a popular magazine on natural history, Dr. Cowdry and his son, Mr. N. H. Cowdry, of York Mills, and Messrs. Saunders and Bethune. The following gentlemen were unable to be present, but became original members of the society: Mr. E. Baynes Reed, Barrister, London, Mr. E. Billings, editor of the Canadian Naturalist and Geologist, for many years attached to the Geological Survey. Mr. R. V. Rogers, Barrister, Kingston; Mr. T. Reynolds, Engineer of the Great Western Railway, now part of the Grand Trunk system, Hamilton; Mr. B. Billings, Prescott, who subsequently lived in the neighborhood of Ottawa and formed a large collection of Coleoptera; Rev. V. Clementi, Peterborough, an English Church clergyman, who was greatly interested in the various aspects of

natural history. Mr. Wm. Saunders was appointed by the Dominion Government in 1886 to establish and superintend a series of Experimental Farms extending from Nova Scotia to British Columbia For twenty-five years Dr. Saunders conducted this work in a most able and successful manner, and his name is well known not only throughout Canada, but also in the United States and Great Britain.

The Society thus formed began its career of active usefulness and it has steadily grown and prospered to the present time. In 1868 the publication of the Canadian Entomologist was begun, the first number consisting of only eight pages. It is now in its 45th year of publication and is sent to all parts of the world. In 1870 the first Annual Report of the Society on Noxious, Beneficial and other Insects was published, the three contributors being Dr. Saunders, Mr. Baynes Reed and the speaker. What really made the fortunes of the Society was the invasion of Ontario by the Colorado Potato Beetle. The Board of Agriculture for the Province requested the Society to report on the insect and to advise as to the best methods of checking or controlling its ravages. An admirable report was prepared by Messrs. Saunders and Reed, the former being a practical chemist was able to experiment with various poisons and to discover that Paris green was the most convenient and reliable substance for the destruction of the beetle. The result of this report was a grant from the Department of $100 per annum, which was afterwards increased to $1,000 and the incorporation of the Society under the name of the Entomological Society of Ontario. For a few years the Canadian Institute in Toronto gave the Society the privilege of using its library and museum for its meetings and collections. After a few years, however, the headquarters were removed to London and continued there until 1906, when a change was made to the Ontario Agricultural College, Guelph.

The speaker expressed the great pleasure which it gave him and his colleagues to find that so many friends had come from long distances to join in the celebration of the Jubilee Meeting of the Society. He joined in giving them all the most hearty welcone and expressed his hope that they would fully enjoy their visit.

GREEN LANES AND BYWAYS.

BY REV. THOMAS W. FYLES, D.C.L., OTTAWA.

I.

OLD COUNTRY LANES.

"Through the green lanes of England, a long summer day,
When we wandered at will in our youth's merry May;
When we gathered the blooms o'er the hedge-rows that hung,
Or mocked the sweet song that the nightingale sung.

In the autumn we knew where the blackberries grew,
And the shy hazel-nuts hidden deep in the shade;
And with shouting and cheer, when the Christmas drew near,
In search of the ripe ruddy holly we stray'd."

These lines appeared in the "Illustrated London News" for January the 24th, 1852. They are dear to my remembrance, for they were sung to me by a much-loved companion—long gone to his rest—as we strolled along an English lane, one day in the summer, after their appearance. From this friend* I received my first lessons in Entomology.

The enclosures in the rural parts of England, by which the road-ways pass, have been from times immemorial, and for the most part they are known each by its proper name, as "Nether lea," "Ea-side," "Haly-well Croft," Twenty acres," "Basket lot," etc. The boundaries of the fields are quickset hedges, with ditches on the outer sides. Six feet from the roots of a hedge was allowed for the ditch.

The original growth of the hedges was Hawthorn (*Cratægus oxycantha* L), but, as time passed on, birds and other agents dropped seeds of many plants among the thorns. The most noteworthy of the intruding growths are: Blackthorn (*Prunus spinosa*), Dog-rose (*Rosa canina*), Honeysuckle (*Caprifolium perfoliatum*), Holly (*Ilex aquifolium*), Traveller's Joy (*Clematis vitalba*), Elder (*Sambucus nigra*) and Bindweed (*Convolvulus sepium*).

The mud from the ditches—washings from the roads and fields—is thrown up periodically to the hedge-bottoms, and the fresh soil maintains the varied growth in constant vigour.

*Mr Edwin Tearle, in after years Rector of Stocton, in the Diocese of Norwich.

Some of the byroads of England were formerly important highways. In a tour I made, in my youth, to Tennyson's country in North Lincolnshire, I came one day to a little place that, I was told by a countryman, was "Spittle-in-the-Street." After a little thought I understood the name. "Spittle" was *'Spital*, a contraction of *Hospital*, and the "Street" stood for the *Stratum*, the Roman way from Lincoln (*Lindum Colonia*—the *Colony-in-the-Marsh*) to the Humber. Yes, along that way, centuries ago, marched the legionaries of the Cæsars, in stern array, while the woad-stained Cortiani peeped out upon them from their coverts, in hatred and fear.

In after and pre-reformation days, a religious house of entertainment for travellers was erected beside the ancient roads, and this was the Hospital-in-the-Street. There remained of it a farmhouse and the chapel. In the latter a clergyman from a neighbouring parish held services at stated intervals.

In some parts of England where the country is of rolling surface, and the soil light—the lanes being frequently cut up by heavy farm waggons, and but little cared for—the soil is constantly washed by the rains to lower levels, and hollow ways are formed, such as those spoken of by Kirke White in one of his sonnets:

"God help thee, traveller, on the journey far,
The wind is bitter keen, the snow o'erlays
The hidden pits and dangerous hollow ways,
And darkness will involve thee."

In that powerful description of the Battle of Waterloo, given by Victor Hugo in *Les Miserables*, we are told of a grand charge made by three thousand five hundred French cuirassiers upon the English centre. At full speed, in the fury of the charge, the warriors came to the hollow way of Ohain, twelve feet deep, of which they were unaware. Unable to check their steeds, they plunged in, one upon another, and piled up—a writhing mass, crushed and broken. "One-third of Dubois' brigade"—says Hugo—"fell into that abyss." "This," he says, "began the loss of the battle."

But let us quit the contemplation of disasters and consider the delights of English lanes. And, truly, those lanes are delightful

—with their hedgerows gay with blossoms, diffusing sweet perfumes and jubilant with the song of birds!

English hedges are famous nesting-places for many of the feathered tribes. I can recall the pleasure of my first inspection of the nest of the Long-Tailed Tit (*Parus caudatus*). It was a seemingly compact ball of the finest and greenest moss; but it had on one side a small round entrance, closed with a feather. The tit lays many tiny white eggs, spotted with lilac.

Another nest that attracted my attention in my early days was that of the Red-backed Shrike (*Lanius collurio* L). The mother bird was sitting on her pretty, cream-coloured, richly spotted eggs. Meanwhile her mate was busy attending to her wants. He kept her larder well supplied. On the thorns around her were impaled little blind mice and callow birds, shewing that the common name of *Butcher-bird* was justly given to this feathered pillager. But—as an Eastern Township housewife said in praise of her husband, so we may say of the Shrike—"He is a good provider."

It is said* that the English ornithologist, Gould, dated his interest in bird life from the time when, in his childhood, he was lifted up to see the pretty blue eggs in a hedge-sparrow's nest.

Here and there, in the South of England, a lane leaves the enclosures and traverses a piece of common land covered with bushes of the Furze (*Ulex europæus*). This strange plant, which has spines instead of leaves, is, in its season, gorgeous in its wealth of golden bloom. Linnæus, on first beholding it upon Wandsworth Common, fell upon his knees and thanked God who had created a thing so beautiful.

Elsewhere the lane enters, it may be, a stretch of woodland, the game preserve of the lord of the surrounding Manor; and there, truly, the wayfarer is in the midst of charming sights and sounds. In early spring the woods around him are ankle-deep with blue-bells, anemones and primroses. Later in the year the stately foxglove (*Digitalis purpurea* L.) rears its shafts of purple bloom, and "lords and ladies" look out from their stalls.

Many beautiful butterflies sport around. I can mention but a few of them. The pretty Speckled Wood (*Lasiommata ægeria*)

*Country Walks of a Naturalist with his Children, p. 109.

is everywhere in evidence. The lovely Peacock (*Vanessa io*) and the Brimstone (*Gonepteryx rhamni*) shew well against the surrounding foliage. The Silver-washed Fritillary (*Argynnis paphia*) flits over the brambles, on which its larvæ feed. Once in an age a Queen of Spain Fritillary (*Argynnis lathonia*) makes its appearance—blown over, it may be, from France. The Bath White (*Pieris daplidice*) sometimes shews itself, and formerly the Black Veined White (*Aporia crataegi*) could often be seen.

Years ago, in such a wood, I saw what English entomologists seldom see—a specimen of the Camberwell Beauty (*Vanessa antiopa*). It came sailing over the tree-tops and lit upon an oak sapling immediately before me, and then opened its lovely wings. A moment—and it was gone! And I saw it again no more.

Where oak trees are plentiful in the forest, the monarch of English butterflies, the stately Purple Emperor, may sometimes be seen, and there the Purple Hairstreak will surely be found.

Remarkable instances of insect mimicry will engage the attention in such a wood. Here by the road-side is a bush of Broom—the *Planta genista* of olden times, from which the great Plantagenets of English History derived their surname:

"That name Count Geoffrey did assume
When, riding to the chase,
He wore in his casque, instead of plume,
A nodding crest of the yellow Broom,
In its fresh and fragrant grace."

As the traveller approaches the shrub, he will be surprised to see a number of supposed *leaves* of the plant detach themselves from the twigs and flutter away. They are specimens of the tiny Green Hairstreak (*Thecla rubi*).

At another time, noticing the long cylindrical catkins of the Birch, he will be astonished to see that which he had taken to be one of them move away with alternate loops and strides. It is a larva of the Large Emerald Moth (*Geometra papilionaria* L.).

In the woodland lane the ear is—"charmed with concord of sweet sounds." Suppose yourselves in such a lane—call to your imagination its sights and sounds, and—

Let us recline beneath this tree,
So ragged with lichens—ragged and gray;
Its fretwork of leaves shall our canopy be,
Our carpet the moss where the sunbeams play.

And we'll list to the pipes of the robin and wren,
To the flute of the merule so loud and clear,
To the trumpet call of the cuckoo, and, then,
To the deep bassoon of the stock-dove near.

See you the black-cap 'mid the leaves!
With his glad song his bosom heaves;
His efforts rouse to rivalry
The pride of all Pan's company.

Of choristers, sweet Philomel,
And now soft cadence and rich swell,
And hurried note and note prolonged,
Echo the glades and thickets through;
As oft, when Sol is borne from view,
In his car of crimson clouds they do,
Till heaven with listening stars is thronged.

—T. W. F.

The linnet, the goldfinch, the bullfinch, the greenfinch, the whitethroat, the yellowhammer, the thrush, the misselthrush, and other birds, do their best to render the concert of the feathered tribes effective.

Here and there in the road-side hedges a crab-tree may be seen, and here and there a holly.

The holly is sometimes grown as an ornamental hedge. John Evelyn had such a hedge, and he tells how the Czar of Muscovy (Peter the Great) and his outlandish crew amused themselves by trundling one another in a wheel-barrow, backwards and forwards through the prickly barrier. Evelyn had lent his house and grounds for the accommodation of the Muscovites. When the foreigners retired, they left a *muss* behind them.

II.

Canadian Lanes.

Doubtless, in olden times, when men were few and land grants under the feudal system extensive, hedging and ditching were ready means for enclosing and draining the land, and they have been enduring means.

In Canada the roads that remind one of English lanes, though in truth they are very different, are such as lead through parts of the country in which the old-fashioned snake-fences still enclose the farms and in which brush has been allowed to grow freely in the angles of the fences. In such localities, old roads abandoned for new ones, concession roads leading to a few homesteads off the main lines of travel, roads through sugar-woods and the uncleared forest—these, in their quietude and freedom from dust, are suggestive of English lanes—though they lack much of their beauty.

I will speak briefly of a few such roads:

The Caledonia Road.— Skirting a tract well known to the naturalists of Ottawa, by the name of "The Beaver Meadow," is a lane connecting the Aylmer Road with the Chelsea Road. It was originally a "Corduroy road," and it still ends in the remains of a swamp, in which *Typha latifolia* grows freely. Improvements in the neighbourhood have altered its appearance: the logs are gone, and the bed-rock is seen in much of its length; and this, in summer, is carpeted with Stone-crop (*Sedum acre* L.).

Alas! the Beaver Meadow has now been cleared, drained and laid out into building lots. The city naturalists will have to go farther afield for their investigations, and the Caledonia Road will soon become a city street. When I lived in Hull, however, I spent many tranquil hours within its quiet limits.

Muddy spots in the road were much frequented by butterflies. In bright days in April hibernated specimens of *Aglais milberti* Godart might be seen there. The spring larvæ of this species may be found feeding upon the young shoots of the Stinging Nettle (*Urtica dioica* L.). I raised two batches of them in 1911. They went into chrysalis in the first week of June. Sixty per cent. of them were parasitised by *Protopanteles atalantæ* Packard. The grubs of this fly issued from the larvæ of the butterfly—not through the spiny upper parts, but—through the tender ventral portions.

They spun their white, compact cocoons in clusters attached to the skins of their victims. The first imagos of *milberti* appeared in my breeding-cage on the 13th of June.

The large Skipper (*Eudamus tityrus* Fab.) might be seen on the Caledonia Road. I had become acquainted with this insect on Mount Royal, where its larvæ fed on the Hog-peanut (*Amphicarpæa monoica* Nutt), but there I had seen it in its short flights only, as it skipped from bush to bush. When there I witnessed its rapid flight through the open for the first time, I was puzzled. Its direct course; the peculiar motion of its wings; the flashes, in the sunshine, of the large, heart-shaped, silvery patches on the under side of the hind wings—all were new to me. I had to catch the insect to make sure of its identity. In the neighbourhood of Hull its larvæ feed on *Robinia pseudacacia* L. It gathers several leaflets of the tree together, binds them, and feeds under their cover.

A stream, the outlet of Fairy Lake, crossed the Caledonia Road, and over it a rude wooden bridge was thrown. At this point the Turtle-head (*Chelone glabra* L.), the Vervain (*Verbena verticillata* H. B. K.), the lovely Swamp Loosestrife (*Decodon verticillata* H.B.K.) and the Joe Pie Weed (*Eupatorium purpureum* L.) grew in a tangle. On the last named the larvæ of the handsome Tiger Moth (*Arctia caja* L.) fed.

Ought not this specific name to be written and pronounced *Caia?* Linnæus, in naming it, probably had in mind the form of words spoken by the bride in the marriage ceremonies of the ancients: "*Ubi tu Caius, ibi ego Caia.*" We have an instance of the use of the long i, or j, in the last of the numerals representing *four* —iiij. *Halleluiah* was spelt with a j in former times; and I once knew a worthy clergyman whose name was Micaiah, but who always spelt it *Micajah*, with a thought, I doubt not, of the sacred name in the 68th Psalm.*

On the growth spoken of above the pretty Neuropteron *Chauliodes serricornis* Say was often to be seen.

Along the Caledonia Road locusts were numerous. In 1909, particularly, our largest species, *Dissosteira carolina* L., abounded.

* Praise Him in His name Jah and rejoice before Him. Psalm LXVIII, 4.

But a natural check to its undue increase came; many of the insects were affected by *Entomophthora grylli*, and the species has not been so plentiful since.

LEVIS MILITARY ROAD.—A by-way of interest to naturalists is the road connecting the Forts on Levis Heights. The ramparts raised for the defence of this road are now overgrown with brush, and bushes and young trees have sprung up on both sides of it. In the scrub the tall *Diplopappus umbellatus* (Miller) grows abundantly, and upon this the galls of *Gnoremoschema gallæ-diplopappi* Fyles may be found.

What a formidable name "Gnoremoschema" is! It was derived, I suppose, from the Greek, Gnorimos—well known, and Cheima—in winter. The insects that cause the galls, however, do not occupy them in winter. Having escaped their enemies and come to perfection, they quit their dwellings in August, or September at the latest.

But in some instances the galls are not without winter tenants, several kinds of Ichneumon flies, having preyed upon the former inhabitants, spin their cocoons within the galls and remain in them till summer comes around.

The young gregarious larvæ of that lovely butterfly *Melitæa harrisii* Scudder may be found, late in the season, in dingy, closely clinging webs, on the stalks of the Diplopappus. In the spring they disperse and thrive rapidly on the young shoots of the plant.

In this locality the Large-leaved Aster (*Aster macrophyllus* L.) grows plentifully. An insect of remarkable habits feeds upon it, viz., *Tricotaphe levisella* Fyles. The larvæ of this species fasten the edges of the large bottom leaves together and thus form ample tents within which they feed. A full description of the insect in its different stages is given in the 33rd Annual Report of our Society on page 28.

Another insect deserving of notice that may be met with along this military road is the fine ruby-winged locust described by Harris under the name *Locusta corallina*. (See "Insects injurious to Vegetation," p. 176).

OLD ST. HENRY ROAD.—This road, when I lived at South Quebec, was a rich hunting ground for the naturalist. No less

than eight species of the Cicindel'dæ frequented it, viz., *longilabris*, *6-guttata*, *limbalis*, *purpurea*, *vulgaris*, *12-guttata*, *repanda* and *hirticollis*.

I took *Lexis bicolor* Grote on this road. *Thecla titus* Fabr. was plentiful there, and *Debis portlandia* Fabr., *Phyciodes nycteis* Dbl. and *Pamphila paniscus* Fabr. were there to be seen.

Where the road passed through damp woods, a plant that attracted attention was the White Lettuce (*Nabalus altissimus* Hooker). Its stout stems rose like spires, from the wayside, tall as a man, and clothed with long leaves. This plant is a habitation and food-store for *Aulax nabali* Brodie. By slitting its stalks late in the season, the cells or cocoons of the species may be found. The imagos bite their ways of exit from their hibernacula in March.

Eastern Township Lanes.—There are lanes and by-ways in the Eastern Townships that more nearly resemble the green lanes of England than those I have spoken of, and interesting objects appear in them. Riding slowly through one such lane in the year 1867, I witnessed a sight which I had never seen before, and which I do not expect to see again, namely—a small flight of Passenger Pigeons (*Ectopistes migratorius*). There were seven or eight of them. They lit on some second growth maples a few yards in advance of me. They flapped their wings, and flirted their long tails, and preened their fine plumage, greatly to my delight.

Two other kinds of birds, especially worthy of notice that came under my observation in the Eastern Townships' lanes were the Great Grey Owl (*Scotiaspex nebulosa*) and the Barred Owl (*Strix varia*). The former whose big round head seemed too large for his body was greatly disturbed at my appearance. It rolled its head and fidgeted and blinked at me, but seemed to doubt the propriety of taking flight—it may have been recently mobbed by other birds. I left it unmolested to its wise cogitations.

The Barred Owl is a smaller bird—trim and alert.

Green lanes in those parts are frequented by the strangely elusive and tantalizing butterfly *Grapta j-album*, Boisd. & LeC. It is an insect of rich colouring and powerful wing. It rises before you, and you watch its direct and rapid flight, and note the spot where it alights. You hasten thither, and, drawing nigh, walk

warily; but, look carefully as you may, you cannot perceive it. Suddenly it starts up, a few yards before you, and dashes away, and so on, till you abandon the pursuit. Its under side is of sober browns, like the fencing on which it usually alights. Gosse took this insect in the "Grove Lane" at Compton, P. Que. He named it the "Compton Tortoise." (See *Canadian Naturalist*, p. 247).

Along a by-road leading to the estate of the late Col. Calvin Hall in East Farnham a row of white elms had been planted. When I took notice of them, they were about fifteen feet high. It was in the Fall of the year, when, from some cause or other, the leaves of the elm curl over, and form rolls, on which the veins of their under sides are very conspicuous.

The trees I speak of had been visited by the Sphinx, *Ceratomia amyntor* Hubner, and I found a number of the larvæ of this insect feeding upon them, Strange to say, the larvæ took positions in which they closely resembled the rolled leaves—the ribbed side-lines of the caterpillars mimicking the veins of the leaves.

As the season advanced, the leaves of the elms changed from green to rusty brown, *and a corresponding change took place in the colour of the larvæ.*

But it is time I brought this paper to a close. It is one of reminiscences—a record of days gone by. I have written it in the hope that some into whose hands it may fall may be led by it to take a deeper interest in Nature Studies, to perceive a little more clearly some of the beauties in God's marvellous works, and to look up with deeper feelings of love and reverence to Him, for whose pleasure all these things are and were created.

THE CANADIAN ENTOMOLOGIST.

Owing to the greatly increased cost of printing of late years, it has been found necessary to raise the price of this magazine from $1.00 to $2.00 per annum, payable in advance. This includes postage to any part of the world. The change will go into effect with the beginning of the volume for 1914. Members of the Society, who are residents within the Dominion of Canada, will receive the magazine and annual report without charge if their subscriptions have been duly paid in advance.

THE IMMATURE STAGES OF THE TENTHREDINOIDEA.

BY ALEX. D. MACGILLIVRAY,
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An interest in the study of the adults of the Tenthredinoidea has emphasized the necessity for some knowledge of their immature stages. This opportunity came the past summer through the offer of the Maine Agricultural Experiment Station to spend some time there collecting, breeding, and studying the larvæ of this group.

It is essential in all phylogenetic studies that the most generalized forms should be identified and the lines of specialization from these forms determined. This identification has been made for the adults and it was hoped that a study of their larvæ would throw some light on the validity of this classification.

The eggs are laid by the female within the tissue of the host plant. Where the larvæ are borers, the eggs are laid in holes made in the stems of shrubs or in the hard wood of the limbs or trunks of trees, with a thread-like ovipositor. Where the larvæ are leaf feeders, the eggs are placed in slits made by the female from the under surface, with an ovipositor consisting of two plate-like structures. The number of eggs placed in a single leaf varies greatly among the different species. In some only a single egg is inserted in a leaf; in others a large number, varying from three or four to thirty or forty. The recently laid eggs are difficult to locate, but they become swollen with age and then their location is easily determined.

The method of placing her eggs adopted by the female determines, to a certain extent, the feeding habits of the larvæ, as to whether they are solitary or gregarious feeders. Many species are solitary feeders throughout their entire life, a single larva on a leaf, part of a bush, or entire bush; the others are gregarious through the placing of many eggs in a single leaf or on closely adjacent leaves. Where many eggs are laid in a single leaf, the larvae developed from these eggs may be gregarious throughout their entire larval life or only for a time, when they are half grown they gradually disperse over all parts of the bush and are solitary in their habits for the remainder of their life.

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The embryo requires from twelve days to three weeks to complete its development, the length of time varying considerably with the species. While the larva of each species passes through a definite number of instars, the number varies considerable among the different groups of species. The larvæ usually require about fifteen days for the completion of their growth.

There is great variation in their method of feeding. The great majority of the nematids are edge feeders; they cling to the edge of the leaf with the thoracic legs and when disturbed, bend their abdomen back onto the thorax in an S-shaped curve. Many emphytids and selandriids rest with their body stretched out flat on the underside of the leaf and eat holes in the leaf or feed from the edge; others, while feeding in a similar manner, rest with the body curled helix-like, with the anal prolegs forming the apex of the helix. This is also true of the cimbicids, *Cimbex* and *Trichiosoma*, which are edge feeders, resting curled on the upper surface of the leaf. A few nematids and selandriids also feed on the upper surface—some with the body helix-like, others extended. The phyllotomids, including the genus *Caliroa*, are leaf skeletonizers, feeding only on the parenchyma of the under surface. The very young larvæ of many of the groups are also skeletonizers during the first or second instars. The lophyrids, which feed only on conifers, begin at the the free end of the needle, clasping it between the prolegs, and eat towards its base until only a stub is left. The dolerids, or what I believe to belong to this group, for none of the American species have been bred, feed on sedges (*Carex*), feeding on the ends of the blades; the same is true of some of the grass-feeding nematids. The pamphiliids are either gregarious, when they fasten several leaves together into a nest with threads of silk, or solitary, when they roll the edge of the leaf and fasten it together with silk. These larvæ are the only ones, so far as I know, that use silk in this way. The fenusids and scolioneurids are leaf miners.

The body of the larva may be either black, white, green, spotted or banded. A large proportion of the species are white or green. In the green species the colour is due, in great part, to the colour of the blood and the food contained in the alimentary canal. They are also usually banded dorsally (the dorsal blood vessel) and marked on each side of this band and along the pleura by frosted

lines (the dorsal pleural air tubes). A few species are marked on the dorsum and some on the pleura adjacent to the spiracles of certain segments by large yellow patches, which are due to lobes of adipose tissue or fat, which show through the cuticle. Many species are marked with pigmented colours; only one so far as observed has a median dorsal line, *Cimbex*. There is great variation in the arrangement and time of appearance of these colours. The entire body may be black or brown, or consist of longitudinal or tranverse rows of spots. Larvæ that are white when they emerge from the egg, may be entirely or almost black or chocolate brown in the latter part of their larval life, while those that are black when they emerge from the egg, may be almost entirely light-coloured when mature.

The larvæ, when fully fed, moult their skins and seek a place for pupation. This last moult may take place before they leave the host plant or after that time. There is no striking difference in the form and appearance of the body of most of the green or white larvæ, but those with prominent spines and black spots loosen the spines and spots and become opaque white; some that are white become distinctly spotted; some that are black or black-spotted become green, white, or glassy green, and still others that are opaque white through all the preceding stages have black spots about where the setæ were located. This diversity in form in the different stages makes it very difficult, until both stages have been recognized for a given species, to determine whether you are working with one or two species. This last larval stage has been designated as the ultimate stage by Dyar, who has done more toward elucidating the life-histories of the American species of sawflies than all the other workers together.

After the assumption of the ultimate stage some larvæ remain quiet for a time, resting upon the food plant; but the great majority leave the host plant and wander about in search of a place to prepare for pupation. The xyelids, pamphiliids, and blennocampids form cells in the ground, the emphytids and selandriids bore into rotten wood; also some nematids, which have the same habit, and so far as observed all these have a striking ultimate stage. The end of the tunnel is plugged with frass and the cavity left unlined with silk except a few species, which make a very thin

cocoon. The great majority of the larvæ of the saw-flies form cocoons just beneath the surface of the ground or among the debris on its surface, as the lophyrids, dolerids, phyllotomids, tenthredinids, holocampids, acorduleceridsi, hylatomids, and most nematids. Some individuals of the first brood of the lophyrids attach their cocoons to the leaves of the host plants. The cocoons of the acorduleceridsi are white and compact; those of the hylatomids large, white and lace-like; while in all the others the cocoons are dense and black or brownish in colour.

In most insects, when the cocoon has been formed by the larva, it transforms almost immediately to a pupa—at least, within a week or two. A different condition is found among the larvæ of the saw-flies. Some of the species are, so far as known, always single brooded; the larvæ of such species emerge early in June, complete feeding in a few weeks, enter the ground or rotten wood, form their cocoons or cells, but live as larvæ within them until the following spring, when they transform to pupæ, and emerge as adults in May or June. A similar condition is found in those species that are apparently more than one-brooded, the ultimate larval stage is long and the pupal stage short. Writers frequently refer to the time when the larvæ form their cocoons or enter the ground as the beginning of the pupal stage. Such a designation is clearly incorrect.

Any statement as to the number of broods of any given species of saw-fly should be made with reservation. Many insects, probably a large majority, appear at a definite, stated time, usually not exceeding a period of two or three weeks and sometimes less. Such a condition does not exist in this group, for adults may appear over a period of four to eight weeks, so that it is possible to find on the same host plant and even on the same leaf, if the plant be one that has large leaves as a dock (*Rumex*) larvæ that are fully grown, others that have just emerged from the egg, and various sizes between these. Such a condition in June would probably mean that they were larvæ from the eggs of females produced from wintering larvæ, but in July the young larvæ may have been produced from the eggs of females that have matured the same season or from females produced from wintering larvæ that have been very slow in development. The field conditions would warrant considering

such a species as single brooded, while the breeding experiments show conclusively that it is two brooded. The determination is further complicated by the fact that in those species producing summer females, not all the larvæ transform the same season, but, with the exception of a few species, the great majority of the females do not appear until the following spring. So that the second so-called brood is in reality only a partial brood; this is a well-established fact in the case of *Lygæonematus erichsonii* and *Pteronus ribesii*. In some species there is evidently a partial third brood.

The pupæ of saw-flies do not differ from those of other Hymenoptera. The antennæ, legs and wings are enclosed in separate cases and lie free on the breast of the insect.

The fact that saw-flies produce only partial second or third broods is also substantiated by the scarcity of adults during July and the following months. This time will vary somewhat, depending upon the altitude and latitude of the location. In most regions the adults are found in greatest abundance in May and June. They should be sought on the leaves of plants along the edge of forests, along fences and roadsides, and on the plants of marshy places.

ADAPTATION IN THE GALL MIDGES.

BY E. P. FELT, ALBANY, N.Y.

Adaptation is defined in the Century Dictionary as an "advantageous variation in animals or plants under changed conditions." This definition is sufficiently broad to include practically every modification resulting in a variation from what might be construed as the normal for a given family, tribe, genus, or even species. It is well known that every animal is exposed to numerous natural hazards during its life. Existing species must be equal to these perils or become extinct. It is convenient to group the forms of adaptation under three heads.

1. *Strength, aggressive and defensive.* We can all recall forms which appear well-nigh invincible because of superior physical development—muscular or defensive. The lion and rattlesnake represent two familiar and diverse types belonging in this category. One is remarkable for its superior muscular development and the other possesses a peculiarly efficient means of defense.

2. *Prolificacy.* There are numerous species with no particular physical efficiency. Some of these latter owe their existence largely to prolificacy. The common river shad, for example, may produce from 60,000 to 156,000 eggs, while a seventy-five pound cod may contain 9,100,000 ova. This extraordinary prolificacy is evidently a provision of nature to offset the numerous perils threatening the fry. Some of our plant-lice attain the same end by producing a number of generations annually. For example, the common hop plant-louse is capable of producing twelve generations in a season, the final progeny amounting to over ten sextillion. The increase in this latter species is by geometrical, not arithmetical, progression.

3. *Evasive adaptations.* There are hosts of species which escape extinction by the exhibition of more or less cunning in avoiding the many natural perils. This may be the result of modifications in the biology, peculiarities in habit, specializations in structure, or even cryptic or other resemblances. We have sometimes wondered if these factors, physical development or strength, prolificacy and evasive adaptations could be assigned sufficiently exact values that, if two were known, the third could be ascertained.

The gall midges exhibit a most interesting condition. The approximately 800 American species known probably represent only one-third to one-fifth of our fauna. Some 450 species have been reared from 183 plant genera representing 65 plant families. The largest of the gall midges is only about one-fourth of an inch in length, while the smallest measures scarcely one-fiftieth of an inch. Local in habit, slow of flight, fragile in structure and far from attaining an extraordinary prolificacy in many instances, how do these multitudinous species maintain themselves? Physical development, either aggressive or defensive, is hardly worth mentioning.

Biological adaptations. There are good reasons for believing that gall midges are allied to the fungus gnats or Mycetophilidæ, many of which live as larvæ in decaying organic matter. The inner bark of various trees in incipient decay may contain hosts of Miastor and Oligarces larvæ. These maggots are remarkable because they exhibit a modification of parthenogenesis known as pædogenesis, an adaptation of inestimable value to species living

under such conditions and dependent upon weakly organized adults for their establishment in favourable conditions. These midges produce only a few eggs and evidently possess very limited powers of flight. The larvæ are capable of penetrating only the weaker, semi-rotten tissues of bark and sapwood and are preyed upon by voracious maggots belonging to the genera Medeterus, Lonchea and Lestodiplosis. All too frequently the only evidence of Miastor infestation is the abundance of predaceous maggots which have devoured practically every inhabitant of a once populous colony. The ability to produce young in an indefinite series of generations by maggots advancing in unoccupied tissue is a great advantage in avoiding such enemies as those mentioned above. We also have in this series of pædogenetic generations an example of multiplication by geometrical progression such as obtains among our plant-lice.

Certain species like the Hessian-fly, sorghum midge, violet midge and rose midge depend for existence to a considerable extent upon the production of several generations annually; in other words, increase is by geometrical progression. The extraordinary efficiency of this form of adaptation is strikingly illustrated in plant lice as mentioned above. Such species, if able to subsist upon farm crops or other products valuable to man, are potentially serious pests. One generation annually appears to be the normal for many midges, and consequently the ability to produce more in a season must be considered a favourable adaptation to existing conditions.

Midge galls. Recalling the fact that the more ancient type of gall midges appears to be related to the fungus gnats or Mycetophilidæ and that they furthermore exhibit similar preferences in that the larvæ occur in organic matter in various stages of decay, one would expect to find a series of galls showing gradual modifications from this comparatively simple habitus to the more complex type of shelter so frequently observed in this group.

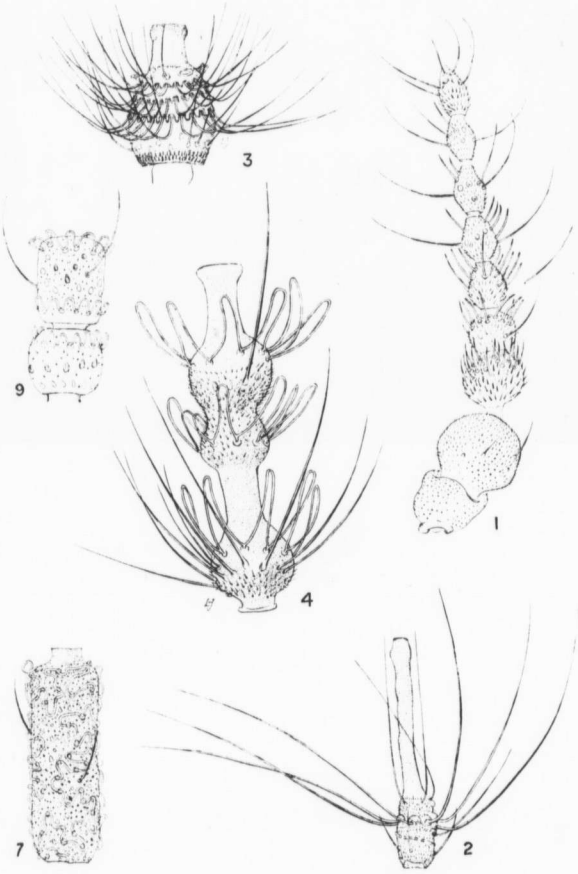
Bud galls. Possibly the simplest type of midge gall is to be seen in the irregular, loosely and various developed bud galls produced by some species of Dasyneura and its allies. The eggs appear to be simply dropped among the developing floral organs or leaves and the larvæ obtain their sustenance by absorbing nutriment from adjacent tissues. The weakening of the latter prevents

normal development and, in some instances, at least, we have the conspicuous and rather characteristic rosette galls such as those of species of Rhopalomyia upon Solidago and of Rhabdophaga upon willow.

The growing point of a plant stem, whether it forms a leaf, bud or a flower, affords such ideal conditions for nourishment, that it is not surprising that certain genera should be restricted in large measure to such favourable habitus. This is particularly well marked in Asphondylia and certain of its allies, which not only confine themselves largely to bud galls, but have become so specialized that they are particularly adapted to the production of such deformities.

Leaf galls. The leaf gall, like the bud gall, usually begins as a development upon expanding or tender tissues. The simplest type is probably a marginal leaf roll, and this differs from certain of the bud galls simply by the fact that in the roll only a portion of the leaf is involved, while in the bud gall all of the several leaves may be distorted or have their development arrested. Vein folds are produced simply by the larvæ congregating or restricting their operations to this portion of the leaf rather than to the margin. They vary greatly in character and may be limited to the midvein or to the lateral veins, may be comparatively simple and composed of greatly hypertrophied tissue or ornamented with a conspicuous white pile or other development such as is found in that of *Cecidomyia niveipila* O.S. These leaf rolls and vein folds are usually produced by a number or small colony of larvæ.

Blister leaf galls and the more highly developed globular or conical galls are generally produced by single larvæ hatching from eggs deposited in or upon the buds before the leaves have unfolded. The peculiar blister galls on Solidago and Aster are multilocular, are easily recognized by the typical discoloration and thickening of the leaf, and are produced almost without exception by the genus Asteromyia. These galls represent a slightly more advanced condition than obtains in certain species which live between the upper and lower epidermis and either produce only a slight discoloration as in certain species of the genus Cincticornia, or else excavate a fairly well defined mine, such as that of *Lasioptera excavata* in Cratægus. The globular or lobulate galls of *Cincticornia globosa*



GALL MIDGE STRUCTURES

and *C. pilulæ*, respectively, as well as the conical and globose enlargements of various species of Caryomyia upon hickory, must be considered as extreme types or modifications of the blister gall.

Stem galls. No part of the plant is exempt from infestation by the small representatives of this large family, be it seed, flower, leaf, stem or root. The stem gall is usually subcortical, and in those produced by midges, development generally begins while the tissues are still in a soft and plastic condition. They are usually polythalamous and are frequently irregular, more or less confluent swellings in the bark.

The medullary, stem or branch galls differ from the preceding in that the larvæ confine their operations to the interior of the affected tissues, frequently restricting themselves to the pith and producing rather characteristic deformities.

Root galls. There are only a few root galls known, probably because of the great difficulty in finding them. There appears to be no marked difference between these and the stem galls, aside from the point of location.

Recalling the fact that gall midge larvæ are small, without defensive armor or apparatus, with masticatory, or boring organs poorly developed or absent, it is obvious that this gall-making habit is one of the most important adaptations in the family. The gall midges have been able to maintain themselves in hosts and in many and varied forms by adaptations which have led to their seeking sustenance and shelter in places comparatively free from invasion by other insects. Not only have these small insects learned to prey upon numerous plants, but some have found it advantageous to wring sustenance from their associates. The species of Lestodiplosis, in particular, may be reared from a great variety of galls, and the larvæ have even been observed preying upon gall midge maggots, especially those of Miastor. Members of this family have also learned the value of other insects as food, and we now have records of a number of species preying upon scale insects, various plant-lice and red spiders.

Intimate relations exist between certain genera of gall-midges and families and species of plants. It is perhaps sufficient to note in this connection that the genus Cincticornia is practically confined to Quercus, Caryomyia to Carya, Rhopalomyia largely to

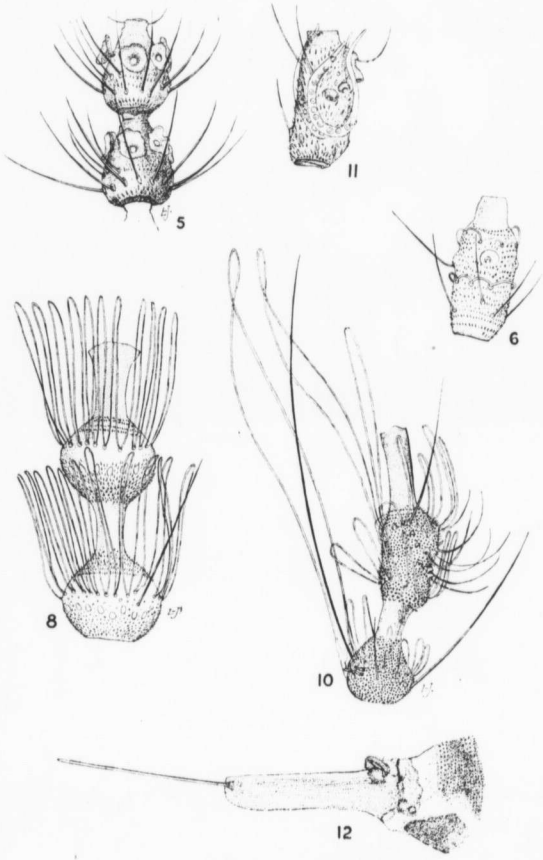
Solidago and Aster, and Rhabdophaga mostly to Salix. The mere statement of these facts indicates a correlation which has been discussed more fully by the writer elsewhere and need not be dwelt upon at the present time.

Structural adaptations. It might be thought that this host of gall midges, with its general similarity of habit, would exhibit comparatively slight variations in structure. Modifications in anatomy almost invariably mean variations in habits ,and consequently they are worthy of note, even though they be but signs of unknown facts, in the same way that irregularities in the movement of a celestial body may mean the existence of an unknown planet. We wish for a few minutes to call attention to some of the more structural modifications.

Antennæ:—The antennæ in this family present a most extraordinary range in development, varying from comparatively insignificant and presumably relatively useless organs with but 8 segments in Tritozyga and Microcerata to the rather highly specialized organs with as many as 33 segments in *Lasioptera quercicperda*. There is an equally great variation in the form of the antennal segment and their sensory organs. The cylindric antennal segment is undoubtedly the more generalized type, as it is the one found most frequently in the Mycetophilidæ. This may be modified to form a cylindrical larger base and a greatly produced distal stem, in some instances the latter attaining a length three times that of the basal enlargement. The basal portion of the antennal segment may be conical as in many Campylomyzariæ or globose as in Joannisia, while in the Itondidinariæ we have a dumbbell-shaped structure, the basal distal enlargements being separated by a stem, with a similar constriction at the apex of the segment. This peculiar modification undoubtedly means greater efficiency in the sensory organs, since they are more widely separated, and is characteristic of the males in one large tribe.

The antennæ of the more primitive groups, such as the Campylomyzariæ and the Heteropezinæ, bear a number of peculiar sensory organs, the more remarkable of which are the so-called stemmed disks in the genus Monardia. These are probably olfactory in function.

The Itonididinæ, as limited by us, may be easily recognized



GALL MIDGE STRUCTURES.

by the presence of peculiar, colourless, thread-like, homogeneous, chitinous structures which we have named circumfili because they invariably run around the segment. They originate or arise from the interior of the segments, are presumably auditory in nature and are discussed by Europeans under the names of arched filaments (verticili arcuata and filets arques) and bow whorls (Bogenwirtel), since these common names aptly describe the structures as seen in the males. These organs in the females generally form a slender girdle near the base and distal portion of the enlargement on the flagellate antennal segments, the two being connected by one or two longitudinal threads. In the males the development may be very diverse. In the case of the male Asphondylia the circumfili consist of a more or less variable series of extremely tortuous, slightly elevated threads reaching from the base to the apex of the segment. In the Itonididinariæ the circumfili of the male are frequently prolonged into a series of bow-like loops girdling the basal and apical enlargements of the antennæ; one on each in the bifili and in the trifili with two on the distal enlargement. The loops of the circumfili or bow whorls may be simply conspicuous sinuosities as in Caryomyia or greatly prolonged on one side and having a length equal that of the entire segment as obtains in Aphidoletes and Bremia. A unique form of circumfili occurs in the genus Winnertzia. Here these structures greatly resemble minute, horseshoe-like appendages, one on each face of the segment, the produced free ends extending beyond the apex of the enlargement, while the supporting vertical threads give the appearance of a series of nails.

The peculiar circumfili, quite distinct in structure from auditory setæ, suggest our latest means of communication, the much vaunted "wireless," and present distinct analogies thereto. Both respond to impulses conveyed through air. It is possible the circumfili are "tuned" to vibrations unrecognizable with our finest instruments, and while the devices of men may convey signals several thousand miles, there is no reason for thinking that these unique antennal structures are relatively less efficient.

Palpi:—The normal number of palpal segments appears to be four, though these organs may become greatly reduced in any one of the tribes and in one genus, Oligarces, appear to be wanting.

The development of these organs affords a good systematic character and is correlated in certain instances at least ,with important modifications in habit.

Wings:—The organs of flight are of great value in taxonomic work and, in this family, present satisfactory characters for the delimitation of subfamilies and tribes. There is a cross-vein connecting subcosta and the third vein which occurs in a well-developed condition in the Lestremiinæ and the Epidosariæ, it being rudimentary or absent in the other groups except certain Heteropezinæ. The presence of the fourth vein is limited to the Lestremiinæ, in which subfamily it may be either forked or simple. The fifth vein also presents important modifications in that it may be simple, in which case there is frequently a sixth vein, or forked, in which latter instance the sixth has become partly fused with the fifth. Certain genera in the Heteropezinæ are remarkable because of the weak wings and greatly reduced venation.

Tarsi:—The normal number in segments is five, members of the Itonididinæ invariably having the first segment greatly reduced. Certain genera of the Heteropezinæ have four; others three, and in Oligarces there are but two tarsal segments. The claws may be simple, pectinate or dentate. They vary greatly in development and the same is true of the pulvilli.

There are other structures presenting equally significant modifications. This is particularly true of the generative organs and is especially well shown in the modified ovipositor which reaches an extreme development in the needle-shaped organ of Asphondylia, an instrument evidently designed for the piercing of thick bud tissues so that the egg may be deposited close to the growing point and in a place where conditions are most favourable for the development of the young.

It will be seen from the foregoing that the gall midges can not be counted as particularly strong or prolific forms, yet they have been able to maintain themselves largely by what we term evasive adaptations, which have resulted in their securing a very large degree of protection at the expense of the host plant. This summary is not intended to exhaust the subject, but is presented for the purpose of calling attention to a group exhibiting numerous unsolved and exceedingly interesting biological and morphological problems. There is perhaps no insect family better

suited for the study of adaptation in numerous ways than the gall midges, a large group which up to recent years has been almost ignored by students.

EXPLANATION OF PLATES XII AND XIII.

1. Antenna of *Microcerata spinosa* male, showing 9 short segments. This organ is shorter in this species than the palp.

2. Sixth antennal segment of *Colpodia diervillæ* male. Note the greatly produced distal stem.

3. Fourth antennal segment of *Prionellus graminæ* male, showing the conical shape and the peculiar whorls of long setæ arising from distinct crenulate chitinous ridges.

4. Fifth antennal segment of *Karschomyia viburni* male, showing a binodose, almost trinodose structure of the segment and the peculiar circumfili or bow whorls.

5. Seventh and eigth antennal segments of *Monardia toxicodendri* female, showing the general shape of the segments and the characteristic stemmed disks.

6. Fifth antennal segment of a *Rhopalomyia* female, showing the generalized type of segment and the low circumfili commonly occuring in the female *Itonididinariæ*.

7. Sixth antennal segment of *Asphondylia monacha* male, showing the low, very tortuous character of the circumfili.

8. Fifth antennal segment of the pear midge, *Contarinia pyrivora* male, showing the binodose character of the segment and the two well-developed circumfili, the latter characteristic of the bifili.

9. Fifth antennal segment of *Caryomyia caryæ* male, showing the short though plainly sinuous circumfili, the three on a segment being characteristic of the trifili.

10. Fifth antennal segment of *Aphidoletes hamamelidis* male, showing its binodose character, circumfili, and particularly the greatly produced loops and setæ on the dorsal aspect.

11. Sixth antennal segment of *Winnertzia calciequina* female, showing the peculiar horseshoe-like circumfili attached to opposite faces of the subcylindric segment.

12. Extended ovipositor of the nun midge, *Asphondylia monacha* female, showing the basal pouch, the thick eversible basal portion of the ovipositor and the highly developed needle-like terminal part.

INSECT GALLS.

BY A. COSENS. TORONTO

(Abstract of lecture, illustrated by lantern slides.)

In the evolution of the study of galls there are different epochs, each merging gradually into the following. From early historical times these abnormal structures have excited attention. In the first instance, this was in all probability due to the fact that they presented phenomena unusual and out of the ordinary. At this earliest epoch witchcraft and like fanciful explanations were proposed to account for their origin. Gradually, as they were better understood and seen to involve a stimulus by a parasite and a response by a host, the examination of them became more scientific, and the hypotheses concering their causes, as a consequence, more valuable. The problem presented was recognized as one of great scientific interest, since it presented the unique feature of a foreign organism stimulating and controlling for its own benefit the growth of a host. Within the last few years it has been shown that a close relation exists between the structure of the bacterial crown gall and certain malignant animal tumors. Thus the second epoch with the subject of theoretical interest seems gradually to be passing into a third in which it will rank as one of the greatest practical importance.

The term "gall" is applied to any enlargement of plant cells, tissues, or organs induced by the stimulus of a parasitic organism as a regular incident in the life history of the parasite.

Galls are divided into two classes, according to the agent that produces the stimulus—namely, *Phytocecidia*, those owing their origin to parasitic plants and *Zoocecidia*, those produced by animal parasites. The former are caused by many different classes of plants, myxomycetes, bacteria, algæ and fungi. Even the flowering plants are represented among the gall producers, since the witches' brooms and the spherical stem swellings on the black spruce are due to the stimulus of the dwarf mistletoe *Arceuthobium pusillum*. The latter are incited by mites (*Acarina*) and by insects in several different orders as follows: *Hemiptera* (Families *Aphididæ* and *Psyllidæ*), *Diptera* (Families *Cecidomyidæ* and *Trypetidæ*), *Coleoptera* (Families *Buprestidæ*, *Cerambycidæ* and *Curculionidæ*), *Lepidoptera* (Families *Gelechiidæ*, *Sesiidæ*, *Tineidæ*),

Hymenoptera (Families *Cynipidæ* and *Tenthredinidæ*). From the Bryophytes to the Spermatophytes nearly all plants are subject to gall formations of this class.

The type of gall produced by the orders Acarina and Hemiptera is simple in structure, consisting usually of a more or less pronounced folding in the leaf of the host, often accompanied in the former by an abundant production of trichomes. The Coleoptera and Lepidoptera originate galls that show little differentiation of tissues and an entire lack of a well-defined nutritive layer. The Dipterous forms are in some cases as simple in structure as the Acarina pouch galls, but in others are as complicated as any of the highest types of galls. In the order Hymenoptera are two families, Cynipidæ and Tenthredinidæ, the members of which produce galls that are in marked contrast to each other. The sawfly galls are characterized by a very pronounced proliferation of tissue without differentiation into distinct layers except at the very earliest stages of gall production. The Cynipid galls, by way of contrast, have invariably three distinct zones of tissues, and only seldom is a fourth absent. These layers have the following relation to each other. Lining the larval chamber is the nutritive zone with cells oriented usually in a radial direction. Bounding this layer on the outside is situated the protective sheath, the zone that is absent in a few types. Outside of that again the parenchyma or tannin zone is differentiated, passing out to the epidermal layer.

One fundamental and far-reaching principle of gall production by insects is that the stimulus does not endow the protoplasm of the host with power to produce new types of organs, tissues, etc. Structures are in many cases originated that are not found on the same part of the normal host, but invariably their prototypes are present on another part of the plant or a nearly related species. The protoplasm is so stimulated that not only are dominant characteristics strengthened, but also in certain cases latent properties are called into activity, and thus the apparent new type of production appears in the host. This principle can be illustrated in the case of glands, trichomes and aeriferous tissue.

It may be stated, as an unvarying rule, that when glands are present in the normal tissue, they are always more plentiful or

larger in the gall originating from that tissue. This is exemplified in the galls produced by *Eurosta solidaginis* Fitch, *Aulacidea nabali* Brodie and numerous other species.

But glands also occur in certain galls on parts of the host that are normally glandless. Thus they are plentiful in the gall produced by *Neolasioptera perfoliata* Felt on *Eupatorium perfoliatum* L, but are not found in the same location in the normal, but are, however, present at the base of the stem. In *E. urticæfolium* Reichard they likewise occur in the transitional region between stem and root, while in *E. purpureum* L they are present in the roots, petioles and flowering axes, as well as in the cortex and pith of the stem. In the case of gland production, it is clear that not only have active characteristics of the protoplasm in that direction been stimulated to an activity greater than the normal maximum, but nearly dormant properties have sometimes been aroused into action.

The trichomes exemplify the principle in a very similar manner to the glands. When the gall produces types different from the normal, these are invariably found on the reproductive axes of the host. The unicellular acicular hairs of *Eriophyes querci* Garman are totally unlike the stellate hairs of the leaf, but their exact counterparts are found on the reproductive axes of the host *Quercus macrocarpa* Michx. The much convoluted type of hair present in the Acarina dimple gall on the leaves of *Acer negundo* L. are found plentifully distributed over the reproductive axes, although the normal leaf hairs are straight. The trichome-producing activity of the protoplasm has thus been stimulated by the foreign organism to a degree reached in the normal only at the time of reproduction.

The production of aeriferous tissue in certain Salicaceous galls also substantiate the principle in a very striking manner. These galls contain examples of a typical aeriferous tissue, comparable, indeed, to that found in such aquatics as Nymphæa, Potamogeton or Saururus; while in the corresponding parts of the host it does not occur. Indeed, this statement may be extended to include all the species of the host genus. A cross section of the gall originated on *Salix cordata* Mühl. by *Rhabdophaga triticoides* Walsh shows this tissue surrounding each larval cell. It is present in the abnormal

stem and extends entirely across the pith. While this tissue is present in the primary cortex of the normal stem of both Salix and Populus, and indicated in the pith of the latter, it is entirely absent from the pith in the corresponding part of the stem of Salix. It is abundant in such primitive regions of Salix as the reproductive axes, nodes and leaf traces. Thus the unexpected appearance of this tissue in the gall cited is readily explainable on the same grounds as in the case of the glands and trichomes—namely, the power to produce this tissue is latent in the protoplasm of the host, and it becomes sufficiently active to reinstate the tissue only when the gall-producing stimulus gives rise to unusual conditions.

A further illustration of this principle is shown in the production of cork in an aphid gall on the leaf of *Passiflora suberosa*. While this tissue is entirely absent from the unstimulated leaf, the stem produces it normally. Also, *Rhodites multispinosus* Gillette stimulates the usually unarmed stem of *Rosa blanda* Ait to the production of an exceedingly spiny gall. The production of spines, however, is a marked characteristic of the genus and a dormant activity has again been aroused.

Concerning the mode of application of the stimulus by the parasite, it may be stated that in none of the orders of insects except the Tenthredinidæ is there any evidence that indicates the beginning of gall formation before the hatching of the larva. In this family the source of the stimulus is in all probability the ovipositor of the insect, since it has been conclusively shown that the gall structure is well advanced while the larva is still within the egg membranes.

From observations on the galls of *Neuroterus læviusculus* and *Biorhiza aptera*, Adler concluded that cell division commenced only after the larva emerged from the egg. Weidel lately has shown that such is the case in the gall produced by *Neuroterus vesicator* Schlecht. It may, as a consequence, be accepted as proven that the source of the stimulus in the galls produced by the Cynipidæ is the larva of the producer.

As already published* the writer has proven by a series of experiments, that the larva of *Amphibolips confluens* Harris

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secretes an enzyme capable of changing starch to sugar, and has also demonstrated the presence of salivary glands opening externally in *Philonix nigra* Gillette and *Amphibolips confluens* Harris. We may conclude, then, that at least one enzyme is present in the salivary secretion of the larvæ of the Cynipidæ and that this acts as a pre-digestive ferment on the contents of the nutritive zone. By its action, starch is changed into a readily soluble substance, and is consequently readily absorbed by the digestive tract of the larva. On account of this amylalytic ferment in the larval secretion the nutritive zone will become stored with an unusually large amount of available nourishment which can diffuse to all parts of the gall. The material thus prepared supplies nourishment for both the larva and the gall. The protoplasm of the latter is thus rendered unusually active since it receives an abnormal quantity of available food material in a limited area. The hypertrophy and cell proliferation and probably also the appearance of vestigial tissue, or other primary characters, are, in my opinion, the response of the protoplasm of the host to the additional food supply.

CHRYSOMELIANS OF ONTARIO.

BY F. J. A. MORRIS, PORT HOPE, ONT.

The title of my paper may be misleading to some of you, and I should like at the outset to explain my attitude. It is simply that of a nature-lover led(more or less by accident) to collect some of the insects observed by him about trees, flowers and leaves, while roaming about the countryside with what Wordsworth calls "a heart that watches and receives."

Of technical knowledge I have little or none to offer, and my interest in the economics of Entomology is subject to prolonged fits of catalepsy; indeed, I doubt if it has ever shaken off this blanket of suspended animation sufficiently to appear in really stark-naked wide-awakeness. The fact is, an amateur collector is drawn chiefly by the giddy pleasure of the eye; most of the time he goes about craving new specimens, probably those of large size and bright colour; he is an enthusiastic and irresponsible schoolboy, easily pleased, easily deceived. I knew a collector once in England —I should have called him then, in my ignorance, an old man—

he certainly had grey hairs in his head—a respectable married man and a regular church-goer, but alas, gentlemen, a lepidopterist in an advanced stage. He greatly coveted specimens of the swallow-tail butterfly. This is almost extinct in Great Britain, though still occasional in the fens of Cambridgeshire; the made-in-Germany kind that are exported from the continent to English dealers, ready set and pinned, did not satisfy him, and at last he was obliged to compromise matters by rearing some imported larvæ and liberating the imagoes in his back garden, in order to catch them again with his butterfly net. Now, what is that but childish make-believe? Unfortunately, most of us left this faculty of self-deception behind in the nursery and are incapable of hoodwinking ourselves so easily. Yet I confess to a greater liking for my specimens of Asparagus Beetle since I took them on wild plants that were not growing in a garden, and I never really loved the Potato Bug and the Squash Beetle till I caught them on my sideof the farmer's fence, the one feeding on the Bittersweet and the others on the blossoms of the Goldenrod.

Moreover, were it not that such a consummation would jeopardize the existence of one of the world's lilies and eventually defeat its own end, I'd sooner see every stalk of asparagus in my own as well as in all my neighbours' gardens devoured by either species of Crioceris(both, perhaps) than invent or discover an insecticide that should prove fatal to so pretty a beetle.

It is, I admit, bearding the lion in his den to appear before an audience largely composed of economic entomologists and talk from so alièn a point of view as this about Chrysomelidæ of all insects in the world; for in the whole order of Coleoptera this is probably the one family that most violently flaunts its existence before the public eye, by the invasion of the kitchen garden.

Is there such a thing as a beetle-fancier, I wonder? If there is, that's what I am, and to show you that I have the courage of my opinions, I invite you all as fellow-members of this Society, or as guests interested in insects, to join me in a cross-country tramp north of Port Hope on a fine day about the middle of July. We shall start from our honoured President's old home of Trinity College School, and in order to enjoy the day thoroughly I'll ask each of you for a little while to fancy yourselves back at school

once more—throw away the burden of years and the cares of a responsible position; drop the handle from your name, college degree and the rest of it—forget it all. What you want is a little zest for the day's captures and (as we shall be out for the day) a sandwich or two in your pocket against the noontide hour.

We have green lanes and fields right at our door, but as our road will in any case be a long one, we shall condescend to get a lift by boarding the morning train for Peterborough and riding as far as Quay's Crossing, five miles up the track. I am giving myself as well as you a treat, for this is a favourite walk, and I may not have many more opportunities of taking it. But for all the hundreds of times that I have trodden these paths and roamed the woods and fields, I do not think I have ever come out entirely or even primarily as a Coleopterist. The countryside all means far more than beetles to me, so I must ask you to pardon the digressions, which may be many. I hope they will not weary you.

During the few minutes of our train ride, let us briefly review the family of Chrysomelians. There are no less than 18,000 species of these leaf-eating beetles known in the world; the vast majority are tropical; North America can claim only about 1-25th of this number and Ontario about 1-70th. But even Ontario's share, nearly 300 species, makes a long list, tne mere detailing of which would take some pages, while anything like systematic treatment, with specific or even generic description would require a volume; it would, besides, be more than tedious—it would be deadly dull. Henshaw's check-list makes about as inspiring reading as the list inspired of Walt Whitman's poems, and for the same reason—it's a mere catalogue. There are purple patches, I grant you, and not a few in LeConte and Horn or in Blatchley as there are in Professor Wickham's papers on the Chrysomelidæ of Ontario and Quebec (contained in volumes 28 and 29 of the Canadian Entomologist, 1896–7). What are these purple patches of interest?—these oases in a desert of dry description? At first sight they seem of varying nature; sometimes a brilliant generalization or an ingenious analogy; at others a quaint observation of habits or a personal experience. But they all resolve themselves, at last, into the personality of the writer. It is the personal element that lends interest to a book or a paper on a technical subject; it is just

this that makes the old-fashioned Lexicon of Samuel Johnston or Noah Webster an enthralling romance beside a modern dry-as-dust scientific work-of-a-syndicate like the Standard Dictionary.

It would obviously be impossible to write an interesting account of 264 species of beetles or even of 96 genera, but for the convenience of systematic treatment, this enormous mass of individuals, countless as the sands of the sea, has been marshalled, like the children of Israel, into 12 tribes, and every one of these tribes has several representatives in Ontario. In our day's tramp we shall run across at least one representative of each tribe, from Reuben the first born to little Benjamin, our ruler: in plain terms, from Donacia, the reed beetle, cousin german to the more ancient Cerambycidæ, to Chelymorpha and Coptocycla the little Tortoise. Of these twelve tribes, the most numerous in boreal America, as well as the most important, are the five numbered VI–X. These comprise more than 450 species out of a total (to the family) of less than 600 and more than 70 genera in a total of about 100; i.e., ¾ of the entire genera and species belong to five consecutive tribes out of the twelve. Of these five tribes, again, two are supreme, the 9th and 10th included by LeConte and Horn in the single tribe of Galerucini or Helmet-grub beetles, with a total of more than 200 species and over 40 genera; i.e., nearly half the family.

In the tropics, where vegetation is most luxuriant, these beetles play an important part in checking the too-lavish growth; but in the Temperate Zone, where civilized man has brought the earth under cultivation, these twelve tribes, the chosen people of my paper, are nothing better than one of the plagues of Egypt, a most distinctive pest, and man's best wits are taxed to prevent an annual loss of many million dollars.

The Chrysomelians represent a later development than the Cerambycidae or wood-borers, and their adaptation to succulent herbage and the deciduous foliage of flowering plants pari-passu, with changes in the vegetable kingdom from sporophytes and gymnosperms, presents in its way as wonderful an illustration of adaptive development as more specific examples like symbiosis which has isolated the Yucca and its moth from all creation, till each depends on the other for its very existence and on the other only.

The larvæ of the Chrysomelians are in general soft and helpless; feeding, as they do, in the open and gregariously, they are easily destroyed; but several factors contribute to their notable success in the struggle for existence: their immense numbers, the rapidity of their growth (which enables them to produce more than one brood in a season), and the ability of the mature insect, in most cases, to hibernate.

A few of them retain traces of an earlier condition in being stem-borers, or in tapping the roots of plants, as the Donacias; and it may be a sort of atavism that impels Cryptocephalus and Glyptoscelis to resort to the needles and bark of white pine.

Our train is now slowing down to let us off at Quay's Crossing, and for the rest of the day we'll have to put our best foot forward, for it is going to be Shank's mare with us. First we go a quarter of a mile east to Mose Robinson's mill-pond and Pine Grove School-house. Just after crossing the stream here we turn south down a grassy lane, flanked on the west by an old snake fence and on the east by a still more ancient stump-fence; the snake fence appears to spring from a bed of fern-oak and brittle bladder. The lane is filled with sweet-briar and the stump fence festooned with wild grape-vine; a fortnight ago the briar and the grape-vine were both in bloom and the lane was redolent with two of the most delicious scents on earth. A little way on, at the foot of a sandy slope, we cross a tiny brook of lovely, cool spring water, its surface mantled with water-cress. Here in the early season, as early as April, are nearly always to be found about the grass-blades, some specimens of the Donacia. This is our representative of Tribe I, a small tribe generically, consisting of two members only; the genus Hæmonia has only one species, but the Donacia (Reed-beetle, as the Greek name implies) has more than 20 species in North America. The kind I have found here is much like a Longicorn, and in early days was mistaken by me for a member of that family; it differs from the Chrysomelians in being long and narrow in shape, usually yellowish brown in colour and of a metallic lustre. The larva feeds about the roots and bases of aquatic plants and has acquired the power of living under water by tapping the air-vessels of its food-plant. It has actually a small process on the body which it uses as a probe. When about to pupate, it encloses

itself in an air-tight cocoon which is fastened to the roots or stems of the food-plant beneath the surface. The beetle is covered on the under side with a pubesence that acts as a perfect aquifuge shedding the water like oilskin. The species found here in the cool days of April is more or less cylindrical (convex on the upper side) and quite sluggish in habit, but the Donacia of the dog-days in the height of summer is a very different creature. I well remember during my first visit to the Algonquin Park how one day I went over with the late Dr. Brodie to the little land-locked Cranberry Lake in the heart of the hardwood forests. It was a glaring hot day, with the sun at its height and perfectly calm. We rowed a boat down to the Cranberry marsh at the foot of the lake, where all sorts of botanical treasures awaited us. On the way we passed through a patch of water-lilies and flushed a covey of Donacias; there must have been hundreds, leaping and flying from the lily-pads, striking the sides of the boat, sometimes in the water, occasionally on our clothes, darting and glittering in the sun like sparks from the molten surface of the cauldron of heat formed by this woodland lake at high noon beneath an August sun. The activity of movement and extraordinary vitality in the sun's heat are not common among the Chrysomelians, but they are among some of the Longicorns, with which the Donacias have a close affinity. Lords, for the nonce, of all three elements, earth, air and water, they moved easily about all three, perfectly at home and at their ease. On cooler days, or when the breeze blows, they love to sit on their beloved lily-pads, like miniature batrachians, their thorax and head partly raised and their antennæ thrust forward alertly, something like the asparagus beetle when it scents danger.

We shall now stroll south about a mile, along the edge of a wood we call the North Wood, a wood sacred by many memories, rich in flowers, the home of some rare orchids, in and about which I have found more than 20 species of ferns and a wide range of warblers and other birds at the spring migration; it is, besides, the scene of many of my best captures among the Coleoptera. Ten minutes' walk brings us to where the wood narrows close to a division fence, running west across meadow-lands to the railway. Just here stands, on the edge of the wood, a hawthorn, whose blossom, for some reason or other, has proved a beetle-trap or bait

for an extraordinary number of species. It was on this blossom that I first captured specimens of the Orsodacna, our representative of Tribe II, and on the top-rail of the snake-fence, beside it I took one of the few specimens I have ever seen of Syneta, another of the four genera contained in this tribe. The Orsodacna (or Bud-gnawer) is said by Blatchley to feed on willow-blossoms, and this season, as early as April, I was on the look-out for it about clumps of willows in bloom, but the only thing new to me that I observed was a small moth dancing up and down in lively zigzag flight over the willow bushes; it was almost as small as a clothes moth, blackish with a cream or white bar near the apex of the wing. From its extremely long hair-like antennæ I should judge it a species of Adela. We have but one species of Orsodacna, and I have always found it in great numbers, once here and once in Lakefield. The specific name is *atra* (black), but it is very variable, and specimens sent by me to Guelph, taken all at the same time off this hawthorn bush some years ago, were returned labelled under no less than four varietal forms. The pigmentation of the elytra, normally black, becomes less heavy and the wing-covers show light brown with darker disks and markings. In some of its forms the blend of colours is very pretty; the beetle is narrow-oblong and the texture of its upper surface is of an oily smoothness.

Let us cross the meadow west to the railway track; near the fence that extends from the hawthorn tree to the railway, on the south side are some sand-drifts where I have captured no less than six species of Tiger-beetle at various times in the season. The meadow to the north is less sandy and springs ooze out from its surface and meander over the grassy slopes. Here in September the meadow is white and fragrant with *Spiranthes cernua*, the nodding Ladies' Tresses, one of our autumn orchids. Just where we strike the railway is an immense patch of that rather rare plant, the Grass of Parnassus, whose green-veined creamy white blossoms in August and September make as brave a show as the anemone in June and July. It is a sure sign of springs in the soil and further south there are traces of an old sphagnum moss swamp; though it is years since the railway hacked away the trees and shrubs, marsh pyrola and the Showy Ladies' Slipper annually rear their upright

stalks and unfold their blossoms for gauze-winged visitors to gather nectar from beneath the July sun.

Here, along the right of way, grows wild Asparagus, and on it you will find at least one species of the Asparagus beetle, which we shall take to stand for Tribe III. The first specimens I ever saw of this beetle were in a Kentish garden; they belonged to the species commonly known as the striped asparagus beetle, and at first I did not recognize the insect—all I had by way of guide was an old book of Stevens with coloured illustrations that were several times magnified. The picture showed a gorgeous insect, in rich dark green and cream hues, which to my excited imagination must be nearly as large as a June Bug. I found ,however, to do the old naturalist justice, that though in the dead insect the sutural stripe, the basal marks and the cross-bar on the elytra appear black on a ground colour of opaque straw-yellow—in life these colours are a rich, vivid, dark green, on a ground colour of translucent cream, extremely beautiful when scanned with a lens. The 12-spotted species, which seems the commoner in Ontario and is apparently more hardy, I first found in the late Dr. Brodie's back garden in Toronto. Until five or six years ago neither species had made its way to Port Hope, but the spotted one appeared in several gardens then, followed a season or two later by the striped, and two seasons ago I first found the *Crioceris duodecimpunctata* on wild asparagus. There is only one other genus in this tribe—the Lema, of which there are no less than 16 species in North America, only a few occur in Ontario, and I have only found one—*Lema trilineata*, a beetle which sometimes shares with one of the Blister beetles the title of "the old-fashioned Potato Beetle"; it feeds on various plants of the Potato family, and I have found it in some abundance on the Physalus or Ground Cherry, while searching vainly for specimens of *Coptocycla clavata*, the Rough Tortoise Beetle. Before we leave the asparagus and return to our little brook a mile north, I may mention that it was on some garden Asparagus at Lakefield that I found my reward for a day's umpiring at a cricket match, in the shape of a beetle called *Anomoea laticlavia*. This is the only species in the IVth Tribe known to me; for though North America has seven genera in the tribe and over 20 species, there are but four genera represented in Canada, each by a single species.

It is, for a Chrysomelian, a decidedly large insect, stout and of striking appearance, light-brown in colour, with a black sutural stripe, which is slightly thickened from about midway down the elytra to near the apex. I have never since seen it on asparagus, but more than once I have taken it feeding in large numbers on willow-shrubs about the right of way, a few miles north of our present halting-place on the Peterborough railway. Last year I discovered it very abundant, almost a pest, on wild grape-vines near Sackville's Swamp, on the South Shore of Rice Lake, between Bewdley and Gore's Landing.

We now return to the little brook where our first Donacias were captured. Just over the fence, on our right hand, is a small pine wood, out of which, indeed, it is that our little brook emerges. This wood is a great place for early morels; it has also yielded some very interesting species of Longicorn and Clerid on the occasional windfall of white pine. Towards the north-east side of it, where our way lies, grows a patch of raspberry canes, where I captured once in full flight, with my hand, that most elusive of dodgers, the Oberea. On the leaves of the raspberry once I saw some tiny dark conical galls, as I supposed, and one of these I tried to tear from the leaf; to my surprise, when I had partly wrenched it aside, it distinctly moved and glued itself back on the leaf. This was something new for a gall, and I pulled it away from its fastenings to find that it contained a live larva, whose legs were kicking frantically to get back to the leaf. You have often seen a refractory man-child plucked suddenly up by the nurse from the place where it was playing? Well, that's how this caterpillar kicked. It was Chlamys, one of two genera that represent the Vth tribe. These insects construct a case out of their own excretions, and under cover of this tiny, steeple-crowned brownie's cap of a case they move about and feed securely; when the time comes to pupate, they simply close the door at which they have grazed and behold a ready-made cocoon. The insect itself is dark brownish black, and covered with little warty excrescences; when alarmed it closes its legs and falls to the ground, where it escapes notice entirely or is passed over by warblers and other insectivorous birds as a pebble or a pellet of dirt; one more instance of protective mimicry preserved in this creature through all stages of its existence.

(TO BE CONTINUED.)

APPLIED ENTOMOLOGY FOR THE FARMER.

BY F. M. WEBSTER, WASHINGTON, D.C.

Of all husbandmen, the true farmer, the grower of grains and forage crops for sale or consumption on his premises, has been the last to profit by the applied science of entomology. He in the past has indeed supposed himself as helpless against the inroads of insects upon his crops as the Indian squaw whose only hope of saving her patch of Indian corn was in the effect of charms and incantations in warding off attacks of wireworms, cutworms and perhaps other similar pests.

The beginnings in applied entomology consisted in dusting garden vegetables with soot, lime, ashes, and, somewhat later, with powdered hellebore. But to the farmer these precautions meant practically nothing. Though his farm might not be a large one, the area was usually too wide to render these measures practicable, even if they proved effective in a small way. It is true that the trapping of cutworms under compact bunches of elder sprouts, milkweed, clover and mullen, "placed in every fifth row between every sixth hill," was known as early as 1838, but these constituted only a trap or baits, the worms found under the traps being killed by some sharp instrument. This measure, however, seems to have never become popular.

The spread of the so-called Colorado potato beetle over the country from the west eastward brought the use of the Paris green and London purple as insecticides to the front, but, again, this did not help in the least the troubles of the ordinary farmer.

The work of Riley, Packard and Thomas, on the western migratory locust, was the first important effort made to aid the farmer in devising practical measures of fighting destructive insects over large areas.

The spread of the cabbage butterfly from the east to the westward brought into use as an insecticide the powdered blossoms of Pyrethrum, but the farmer does not raise cabbage as either a grain or a forage crop.

Studies of the cotton-worm, by Riley and others, brought Paris green again into use and developed that useful insecticide,

kerosene emulsion, but the farmer cannot make use of these in his cultivation of wheat, oats, corn, rye or barley; neither can he apply them to insect pests on his broad acres of forage crops.

In the same way, fighting the codling moth and San José scale have developed the use of arsenical sprays, as well as those of lime and sulphur, crude petroleum and other sprays and washes. But none of these are of the slightest use to the farmer in his fields, no matter how valuable they may have been to the fruit grower.

The farmer has, therefore, largely occupied the position of a skeptical spectator, who, while seeing clearly the benefits derived from applied entomology by his brother husbandman, the fruit grower, the gardener and even the cotton planter, was seemingly himself debarred from sharing in these benefits, because of the measures being inapplicable to his crops, and, even if this were not the case, his wide areas would render their use impracticable.

Besides all this, the farmer has, himself, held somewhat the position of a critical onlooker as the result of other causes.

Before the advent of experiment stations, and even for some time afterward, letters addressed to the members of university faculties, complaining of the ravages of insects and asking relief, brought the actual farmer little consolation. The replies he received to his appeals for relief were usually couched in terms to which he was unused and much of the text of these replies in a language that he did not understand. Moreover, the replies were usually penned by men who had little or no practical knowledge of agriculture, and thus there grew up between the two not only a continually widening breach, but in many cases an absolutely intolerant feeling on the part of each for the other.

This was approximately the relative positions of the man from the campus and the man from the farm, at the time of the establishing of the Experiment Stations, though there were, of course, some brilliant exceptions. Besides this, many, probably the majority, of those who were afterwards to make the Experiment Stations a success, were yet to be trained and given their practical experience in combining the practice and science of agriculture; and it may be stated that the science of entomology, for reasons previously given, has impressed the farmer the least favourably. Farmers

had always looked upon insect depredations precisely as they did other natural phenomena like drouth, storms and floods, fully convinced by ages of experience that nothing could be done to prevent them, and, therefore, they must be endured to the end. Entomological literature, however elementary and popular, they simply would not read. This was, generally speaking, the situation at the time when I was just beginning my entomological work among the farmers of Illinois.

We will now step over the intervening 25 years and look at the situation as it is to-day. It will be an obscure section of the country, indeed, if where there are serious insect depredations going on, we at the Department of Agriculture do not promptly receive a report of it through one or the other of several sources. These reports are received through letters addressed direct to either the Department or Bureau, and are coming each year with increasing frequency, through experiment stations, the press, and last, though not least, through members of Congress.

Perhaps nothing better illustrates the changed condition and rapid growth of agriculture as a science than the immense strides made by economic entomology as applied over and throughout the broad acres of the ordinary farmer. At the present time, instead of receiving a stereotyped reply to his applications for relief, when he applies as an individual, or for his neighbourhood, to the Department of Agriculture, either directly, or, as is becoming every day more frequent, through his representative in Congress, he is very often surprised when, within two or three days after the receipt of his complaint, there appears in his neighbourhood a young man who, in most cases, has grown up a farmer's son on the farm, and, besides this, has had a thorough university training, and, perhaps, is further equipped by having been engaged in the investigation of insects over a wide range of country, including, perhaps, no small number of the United States. Instead of receiving a letter which to him might, perhaps, so far as practical aid is concerned, have been written in a foreign language, he finds that his visitor can go about over his and his neighbours' farms with him and with a clear understanding of the crops cultivated can point out the work of insects and tell then in what manner they might have avoided these injuries and saved their money. He

will tell him of things that, though he may have spent a life time in farming, neither the farmer nor his neighbours have ever yet been able to observe. His caller not only fits into their farm life and speaks to him in the language of the farmer, but is able to explain, in a perfectly natural and intelligible way, much of what to him has heretofore been a mystery. The young man points out to him wherein their farm methods have, in many cases, been primarily responsible for their previously sustained losses by insect attack. The farmer is now in a position to read entomological literature intelligently and with pleasure to himself. It does not greatly matter of what State he may be a resident, if his locality is not too inaccessible and the matter is of more than local importance any of the men located at the fifteen different field stations can be wired instructions that will send them to his relief. In this way entomology as applied to the broad acres of the farm has within the last twenty-five years become completely revolutionized. This means much to the growers of grains and forage crops and to the stock breeder. Moreover, it means almost equally as much to the banker, the manufacturer, and the merchant, all of whom are coming to recognize the fact. It has been my own practice to take up only such investigations as involve several States, leaving local matters to State institutions, where such are equipped for the work, and, when called upon to deal with such, I have urged that the State be at least given an opportunity to help itself, while we stood ready to reinforce their efforts if need be. This course has been followed especially with reference to local outbreaks of grasshoppers. Where investigations can be carried out in any State, as a part of an extended plan of work, notably that of wheat sowing in fall to evade the fall attack of Hessian fly, we have carried out such experiments with the co-operation of farmers at whatever points seemed most desirable for obtaining results which would benefit the greatest number of farmers. In many cases these sowings have been also made in co-operation with State institutions. The alfalfa weevil investigations have been carried on in co-operation with the State agricultural college and station at their request.

Besides the field laboratories there are being carried on field experiments, out on the farms, under precisely the same conditions

as those with which the farmer has himself to meet. These experiments are conducted in such a way that farmers can see just what is done, how it is done, as well as the object of the experiment itself. They can also see what results are obtained, and what we have done, under their conditions, they, under like conditions, can do for themselves; and the proof thereof is right before their eyes in their own fields. We find that these object lessons and personal contact are primarily worth vastly more than whole volumes of literature, and, gradually the farmer is coming to learn that there is help for him as well as for the horticulturist, in combatting insect pests, even though his acreage may be many times theirs and his crops radically different in nature.

ILLUSTRATED LECTURE ON "ANTS" (ABSTRACT).

BY PROF. W. M. WHEELER.
Bussey Institution, Forest Hills, Mass.

By way of preface the lecturer made some general statements in regard to the 5,000 known species and sub-species of ants, described the development and metamorphosis of the individual ant, the various castes, or polymorphic phases represented by each species and the function of each of these castes in the life of the colony. Then the general behavior of ants was treated from the standpoint of the three basic biological activities, namely reproduction, nutrition and protection.

Special emphasis was placed on the behavior of the female, or queen ant and her methods of establishing the colony in contrast with the behavior of the queen honey-bee and with the male ant, which takes no part in the activities of the colony as such, but functions only as a fecundating agency during the nuptial flight. The queen ant was shown to possess all the instincts of the worker forms in addition to some of her own and thus to represent the most complete embodiment or epitome of the species. This statement requires qualification only in the case of certain parasitic and slave-making species, in which the queen is degenerate like the queen honey-bee and no longer able to establish a colony and bring up the first brood of her offspring without the aid of workers either of her own or of an alien species.

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The peculiar structure of the ant's alimentary track was described in some detail, with its "social" and "individual" stomachs, which enable the insects not only to store their liquid food in the most economical manner but also to distribute it equally among the various members of the colony both larval and adult. For the purpose of illustrating this portion of the lecture more fully, the various adaptions of ants to living in very dry regions, such as deserts, were examined, and it was shown that these insects have evolved four very different methods of circumventing the difficulties inseparable from life under conditions that imply a great scarcity of their natural insect food. A certain number of species have exaggerated their primitive predatory instincts and have become rapacious hunters (e.g. the species of *Cataglyphis* in the North African deserts). Others have taken to storing quantities of liquid food in the crops, or social stomachs of certain workers of the colony for the purpose of tiding over the long droughts (e.g. the honey ants of the South-western States and Australia belonging to the genera *Myrmecocystus*, *Melophorus*, *Camponotus*, *Leptomyrmex*, etc.). Other species have become agricultural or harvesting ants (the species of *Messor*, *Pogonomyrmex*, many species of *Meranoplus*, *Pheidole*, *Solenopsis*, etc.), and have therefore become addicted to a vegetable diet. These forms store the seeds of various desert plants in their nests. Lastly, a group of American ants, comprising the species of *Atta* and allied genera, has learned to grow fungi for food on pieces of leaves, caterpillar excrement or other vegetable detritus. Although this habit seems to have originated in the moist woods of South and Central America, several of the species which acquired it were able by its means to invade the deserts of the Mexican plateau and of the South-western States and thus to remain independent of the precarious supply of insect food peculiar to those regions. This represents the most specialized stage of ant dietetics.

The protective instincts of ants, apart from their stinging and biting proclivities, attain their most striking expression in the construction of the nests. The various types of these structures were briefly considered: the small crater nests in the soil, the nests under stones and in wood, the larger mound nests, which are characterized by a superstructure of accumulated vegetable

detritus which is used as an incubator for the larvæ and pupæ, the carton nests constructed in trees by various tropical ants of the genera *Crematogaster*, *Azteca*, *Dolichoderus*, and *Polyrhachis*, and the extraordinary silken nests of *Oecophylla smaragdina* and some species of *Polyrhachis* and *Camponotus*, which are woven by the ants using their spinning larvæ as shuttles.

THE EXCURSION TO GRIMSBY.

In accordance with the prearranged programme, the visiting entomologists were all invited to participate in an excursion to the town of Grimsby, which is situated near the centre of the chief peach district of the Province. About thirty-five availed themselves of the opportunity. It had been expected that the party would arrive in Grimsby soon after noon, but owing to a very severe thunderstorm the previous evening, the electric cars were running irregularly and it was not until about 2 p.m. that we arrived there. Lunch was at once served. After lunch there were two or three very interesting, short addresses of appreciation of the pleasant trip and of the entertainment. Immediately afterwards those who were enthusiastic collectors set out in a body to search the flower-clad side of the so-called mountain for their favorite kinds of insects. The remainder, under the guidance of Mr. Caesar, visited the neighboring orchards, especially the peach orchards. Fortunately the peaches were just ready to pick, and the healthy trees, with their luxuriant green foliage and the branches bending down almost to the breaking point with the weight of golden fruit, aroused the enthusiasm and admiration of those who had never before seen an Ontario peach orchard. About two hours were spent driving through or past peach and other orchards, noting at the same time a few of the special insect pests of the locality, and then all returned to the hotel to meet the party of collectors who reported a considerable number of interesting captures. Farewells were given and the convention was at an end.

L. C.

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REV. DR. C. J. S. BETHUNE, who has been suffering for some years from defective eyesight, recently underwent an operation, which has completely restored the sight of his right eye. We offer him our heartiest congratulations, and feel sure that the news of his recovery will be received with pleasure by all readers of THE CANADIAN ENTOMOLOGIST.

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