Forty-Third Annual Report

OF THE

Entomological Society

OF ONTARIO

1912

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO)

PRINTED BY ORDER OF

THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO:
Printed by L. K. CAMERON, Printer to the King's Most Excellent Majesty
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Printed by
WILLIAM BRIGGS
29-37 Richmond Street West
TORONTO

To His Honour Col. Sir John Morison Gibson, K.C.M.G., etc., etc., etc.,
Lieutenant-Governor of the Province of Ontario.

May it Please Your Honour:

The undersigned begs to present herewith, for the consideration of your Honour, the Report of the Entomological Society of Ontario for 1912.

Respectfully submitted,

JAMES S. DUFF,

Minister of Agriculture.

Toronto, 1913.

CONTENTS.

FORTY-THIRD ANNUAL REPORT

OF THE

Entomological Society of Ontario

1912

To the Honourable James S. Duff, Minister of Agriculture.

SIR,—I have the honour to present herewith the Forty-third Annual Report of the Entomological Society of Ontario.

The Forty-ninth Annual Meeting of the Society was held at Ottawa on the 19th and 20th of November, 1912, and was marked by the unusual variety of subjects discussed and the large number of members who contributed addresses and papers. These, together with the reports of the various officers and branches of the society, are given in full in the following pages.

The "Canadian Entomologist," the society's monthly magazine, has been regularly issued during the past year, and has now completed its forty-fourth volume. It continues to maintain the wide circulation and scientific value which have characterized its reputation in the past.

I have the honour to be, Sir,

Your obedient servant,

EDMUND M. WALKER,
Editor.

Biological Department,
University of Toronto.

Entomological Society of Ontario

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FINANCIAL STATEMENT

For the year ending October, 1912

Receipts.		*Expenditures.*	
Balance from 1911	$ 826 20	Printing	$1,114 81
Members' fees	357 51	Cork and pins	113 59
Advertising	30 75	Expense	70 67
Government grant	1,000 00	Salaries	200 00
Sale of reports and back numbers	109 34	Library	121 35
Sale of cork and pins	120 30	Annual Meeting	24 40
Bank interest	23 87	Annual Report	90 95
		Insurance	26 00
		Bank exchange	7 32
		Balance on hand	698 88
	$2,467 97		$2,467 97

(Signed) A. W. Baker,
Treasurer.

Auditors. { J. E. Howitt.
L. Caesar.

DR. E. M. WALKER,
President of the Entomological Society
of Ontario, 1911-1912.

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Professor of Entomology, Ontario Agricultural College.

Reed, E. Baynes ..... Victoria, B.C.
Director of the Meteorological Station.

The Entomological Society of Ontario

ANNUAL MEETING

The Forty-ninth Annual Meeting of the Society was held at Ottawa on Tuesday and Wednesday, November 19th and 20th, 1912.

Dr. E. M. Walker, President of the Society, occupied the chair during the day meetings, which were held in the Lecture Room of the Carnegie Library, and at the Evening Session in the Assembly Hall of the Normal School, the meeting was presided over by the Hon. Martin Burrell, Minister of Agriculture.

Among those present were: Rev. T. W. Fyles, Ottawa; Mr. W. H. Harrington, Ottawa; Mr. H. H. Lyman, Montreal; Mr. J. D. Evans, Trenton; Dr. C. G. Hewitt, Ottawa; Mr. Arthur Gibson, Ottawa; Prof. L. Caesar, Guelph; Mr. J. M. Swaine, Ottawa; Mr. A. G. Turney, Fredericton, N.B.; Mr. A. W. Baker, Guelph; Mr. A. F. Winn, Montreal; Mr. F. W. L. Sladen, Ottawa; Prof. J. E. Howitt, Guelph; Mr. J. A. Guignard, Ottawa; Dr. R. Matheson, Truro, N.S.; Prof. W. Lochhead, Macdonald College, Que.; Rev. Bro. Germain, Ottawa; Rev. J. B. Mignault, St. Therese, Que.; Mr. J. I. Beaulne, Ottawa; Rev. Father Marcotte, Sherbrooke, Que., and Messrs. J. D. Tothill, G. Beaulieu, G. E. Sanders, H. F Hudson, C. E. Petch, field officers of the Division of Entomology.

In addition to the above, many members of the Ottawa Field-Naturalists' Club attended the various sessions, particularly the evening meeting. Letters expressing regret at their inability to attend were received from: Rev. Prof. Bethune, Guelph; Dr. Wm. Saunders, London; Dr. E. P. Felt, Albany, N.Y.; Prof. C. C. James, Toronto; Rev. J. A. Jean, Montreal; Mr. H. G. Payne, Granville Ferry, N.S., and Mr. G. Chagnon, Montreal.

On Tuesday morning the members met at the Experimental Farm, where a pleasant hour was spent in looking over the specimens exhibited by those present and in examining the fine collections belonging to the Division. At eleven o'clock a meeting of the Council took place, at which the report of the proceedings of the society during the past year was drawn up and various questions of interest to its members were discussed. In view of the fact that next year will mark the event of the society's fiftieth annual meeting, it was decided that a jubilee meeting be held in honour of the occasion, to which delegates from other societies be invited, and that this meeting be held at Guelph about the beginning of September, the exact date to be decided upon later.

The afternoon meeting was held in the Carnegie Library, the proceedings commencing at 2 o'clock with the reading of the reports of the directors on the insects of the year in their respective districts.

REPORTS ON INSECTS FOR THE YEAR.

Division No. 1, Ottawa District—Arthur Gibson, Central Experimental Farm, Ottawa.

The season of 1912 in the Ottawa District was a most remarkable one. With the exception of the first half of the month of July, the weather was exceptionally cool with continual falls of rain. The following notes on the prevalence of injurious insects in the district are presented:—

Insects Attacking Field Crops.

Cutworms. In light soils cutworms were fairly abundant, and in the earlier part of the season did considerable damage in some fields. Young turnips, beets, radishes and newly set-out cabbages and cauliflowers were attacked by the Red-backed Cutworm (*Euxoa ochrogaster*) and the Dark-sided Cutworm (*Euxoa messoria*), the two common cutworms of the district.

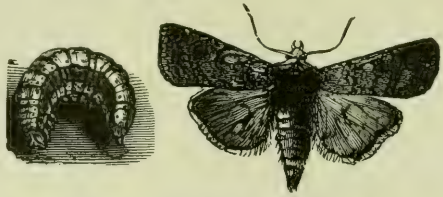

Fig. 1.—Dark-sided Cutworm.

Root Maggots. These insects were not so abundant in 1912 as they were the year previous. They were, however, present in sufficient numbers to destroy many radishes, cabbages, cauliflowers, and, in some fields onions. In one of our fields of turnips on the Farm, 16 per cent. of the plants were attacked by the Radish Maggot. The most interesting outbreak of root maggots was that of the Corn-seed Maggot, which did conspicuous injury to seed corn, not only in the Ottawa district, but also at several points in eastern Ontario. The season was especially

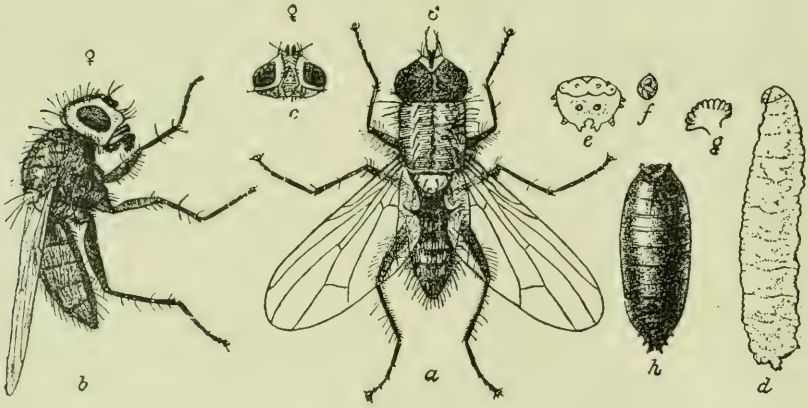

Fig. 2.—The Seed-corn Maggot: *a*, *b*, flies; *d*, maggot; *h*, puparium; all very much enlarged. (After Chittenden, U. S. Dept. Agriculture.)

favourable for this insect, and many farmers thought that the cold, backward spring was responsible for the seed failing to germinate. Unfortunately, our knowledge of the life-history and habits of this insect is by no means complete, and until we have further information it will be difficult to find successful control measures. The remedy which we have suggested in the past is to sow seed corn in good season in well prepared soil and not deeper than one or two inches.

White Grubs (*Lachnosterna*). Strawberries, potatoes and corn were the crops chiefly damaged by White Grubs during the past season. In some fields of corn, near Ottawa, these grubs were remarkably abundant.

Zebra Caterpillar (*Mamestra picta*). Swarms of these caterpillars were found on cabbage leaves at Ottawa on the 18th September. At that time the larvæ were half an inch in length and were quickly devouring the leaves. There are two broods of this insect every year. The winter is passed in the pupal state in the ground and the moths when they emerge in May deposit clusters of eggs on the leaves of low-growing weeds and other plants. I have found them on Lamb's Quarters. The young caterpillars appear in about a week after the eggs are laid and for a time they feed together, but as they reach maturity they separate and feed singly. These caterpillars are full grown in midsummer. This brood some years does serious damage to turnips, cabbages, peas, and clover. The second brood of caterpillars appear in the latter part of August and specimens may be seen as late as the end of October. In late autumn, at Ottawa, they are commonly seen on asparagus plants.

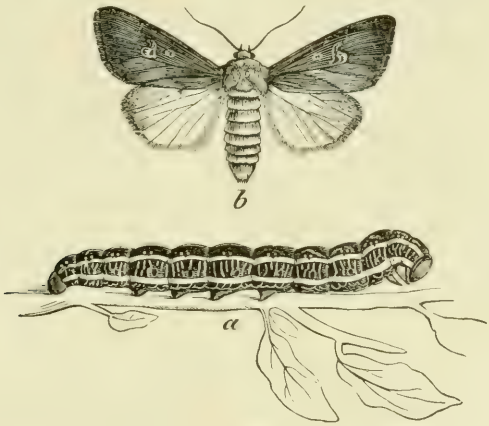

Fig. 3.—Zebra Caterpillar and Moth.

Flea-Beetles. The Turnip Flee-Beetle (*Phyllotreta vittata*) as usual appeared in destructive numbers throughout the district. Another destructive flea-beetle, viz., the Horse Radish Flea-Beetle (*Phyllotreta armoraciae*) was added to our local list of injurious insects. The first specimen observed was seen on radishes in our experimental plots on 31st May. It is apparently established in the district, as three specimens were captured by Mr. E. W. Calvert, at Ironside, Que., which is close to Ottawa, on June 8.

Clover Root Borer (*Hylastinus obscurus*). Is some fields of alfalfa this borer was working freely, causing noticeable loss. In one field examined 31st July two adult beetles were found in a root which had been tunnelled by the larvæ.

The Sleepy Weevil (*Otiorhynchus ovatus*). In our experimental plots of cauliflowers and cabbages the adults of this insect were present in small numbers. In the case of cabbages they were found between the outer leaves of the head, and in cauliflowers they were concealed at or near the bases of the stalks of the head. The finding of this weevil feeding on these plants is of interest. In the Insectory I kept some of the weevils, for about a week, in shell vials, feeding them on pieces of cauliflowers.

Insects Attacking Fruit Crops.

The Apple Maggot (*Rhagoletis pomonella*) (Fig. 4). I regret to report that on Aug. 19, while examining Codling Moth injury in a small crab apple orchard on the outskirts of Ottawa, I saw within a few inches of the apple I had hold of an adult of the Apple Maggot. It was resting on a leaf, and after examining it closely I attempted to catch it with my hand but failed. Several days previous to the above date Mr. E. W. Calvert, who was working temporarily in the Division, reported to me that he had seen in the Arboretum of the Farm a fly which he took to be that of the Apple Maggot. As yet no injury by the larvæ of this fly has been detected in Ottawa.

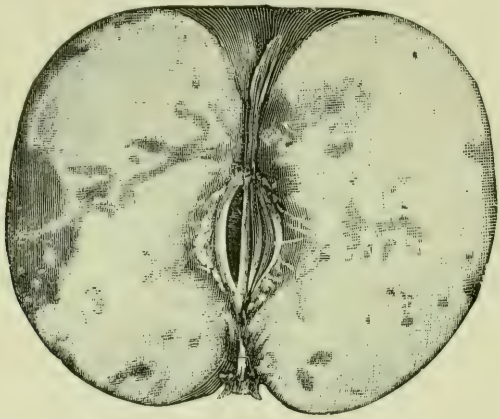

Fig. 4.—Fruit injured by the Apple Maggot.

Orchardists in the district should watch closely for indications of the presence of this extremely destructive insect, and, if found, report any occurrence at once to the Division of Entomology, Central Experimental Farm.

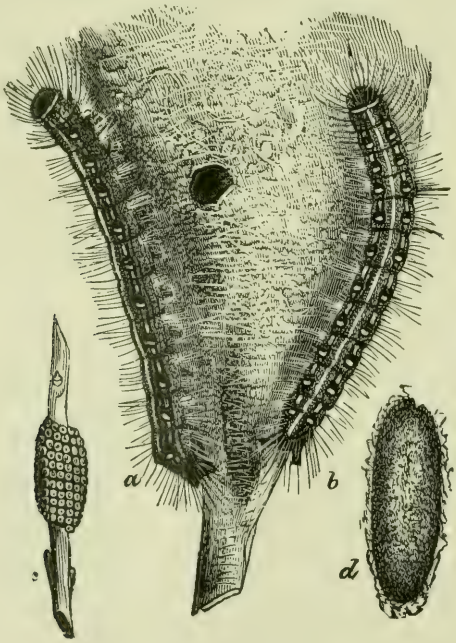

Fig. 5.—American Tent Caterpillars on their web; *c*, egg-bracelet; *d*, cocoon.

THE AMERICAN TENT CATERPILLAR (*Malacosoma americana*). In my report last year I referred to an exceptional outbreak of this caterpillar in 1911. During the past season, however, the insect was present throughout the district in much larger numbers and caused widespread defoliation, particularly of apple and wild cherry trees. The first date this year on which the young caterpillars were noticed to be emerging from the eggs was 30th April. At the end of the first week in May thousands of small nests were seen throughout the district, chiefly on the above two trees. In the latter half of May it was a common sight to see in apple orchards men going around with lighted torches burning the webs containing the caterpillars. Early in June the defoliated trees were very conspicuous throughout the infested area. On June 9, I counted 37 large nests on one medium sized cherry tree. In the Gatineau Valley district in many orchards not a single leaf was left on the trees. This was also the case in orchards, in general, throughout the entire Ottawa District.

Figs. 6 and 7.—American Tent Caterpillar (Male and Female Moth).

THE CODLING MOTH (*Carpocapsa pomonella*) was abundant in unsprayed orchards. It seemed to be more numerous this year than in 1909 and 1910. Other common orchard pests, as the Oyster Shell Scale (*Lepidosaphes ulmi*), the Fall Webworm (*Hyphantria textor*) and the Pear Slug (*Eriocampa cerasi*) were also present in unusually injurious numbers.

INSECTS ATTACKING FOREST AND SHADE TREES.

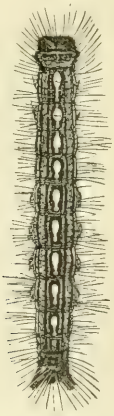

Fig. 8.—Forest Tent Caterpillar.

The most remarkable outbreak of an injurious insect of which we have record at Ottawa occurred in 1912, viz., that of the Forest Tent Caterpillar (*Malacosoma disstria*). In the Gatineau Valley district miles of forest country were stripped

bare on both sides of the river by the voracious caterpillars. The woods of poplar and birch between Ironside and Chelsea, and back from Chelsea to Kingsmere, were entirely denuded of foliage and resembled their winter condition. Such defoliation was complete on June 4th. In the last week of May and the first week of June the caterpillars congregated in thousands upon the tracks of the Canadian Pacific Railway between Ironside and Chelsea. Trains were stopped almost every day during that period, and on some occasions hours were spent in endeavoring to get the train from the former to the latter station, the distance between being only about 3½ miles. Here, however, the grades are heavy and the engine could not make any headway on account of the caterpillars being present on the tracks in such numbers. For a part of the period the early afternoon train for Chelsea had two engines, and on one evening with three engines it was impossible at first to make the grade. Night after night the conductor and fireman or engineer would run ahead of the train and brush off the caterpillars with a broom, or shovel sand over the rails so that the wheels of the engine could get a grip. I never saw such hordes of caterpillars before, and farmers who have lived in the district for sixty years report that they have never experienced such an outbreak. Poplar and birch were

Fig. 9.—Forest Tent Caterpillar (Moth and Eggs).

the two trees particularly favoured by the caterpillars, but maple, oak, ash, willow, apple, wild cherry, and even raspberry, were defoliated. By the middle of June the caterpillars were mature and beginning to spin their cocoons. The first moths began to emerge early in July, but the vast numbers of them did not appear till about the middle of the month. At this time they migrated to the arc lights in the city of Ottawa in myriads and the females were ovipositing on electric light poles, fences, and particularly on shade trees along the city streets. Countless numbers of eggs were deposited, and there is, unfortunately, every indication of another serious outbreak of the Forest Tent Caterpillar in 1913. In the vicinity of Chelsea, Que. (about nine miles from Ottawa), large numbers of the caterpillars were destroyed, just before maturity, by a disease apparently of a fungous nature. They were attached to the trunks of trees, fences, and other perpendicular objects. On one tree I counted 692 dead larvæ. These were massed together on the trunk of a medium-sized tree, and all within about four feet of the ground.

The Spruce Budworm (*Tortrix fumiferana* Clem.). In the immediate vicinity of Ottawa the caterpillars were again fairly abundant, but I did not observe any conspicuous destruction of foliage. Many moths were noticed around spruces on the Farm, particularly in the latter half of July, when many egg masses were deposited on the trees. The first moth reared emerged on June 24.

The Maple Leaf-Roller (*Cenopis pettitana* Rob.). In my report for last year I referred to an interesting occurrence of this species at Chelsea, Que.,

During the past summer the insect appeared in much greater numbers in the same district. During the second week in July the moths were very numerous in the woods, and there was much variation in their appearance, the colour of the wings ranging from almost a pure, shining white to yellow, more or less spotted and streaked with brown or reddish-brown.

Garden and Greenhouse Insects.

Garden plants were not injured by insects very seriously during the past season. The Tarnished Plant Bug (*Lygus pratensis*) was present in fair numbers and was complained of in the latter half of the season as doing some injury to the buds of dahlias. In the early part of the season the Colorado Potato Beetle (*Leptinotarsa decemlineata*) attacked freely plants of the genus *Nicotiana*, and American Rose Slug (*Endelomyia rosae*) did conspicuous damage in some rose gardens. The larvæ of the Bordered Sallow (*Pyrrhia umbra*) were present in

Fig. 10.—Tarnished Plant Bug.

numbers in the rose garden at the Central Experimental Farm. In the middle of July they were found attacking rosebuds, the caterpillars at that time being in different stages from young larvæ to larvæ about one-third grown. It was interesting to note the small numbers of plant lice which were present this year on flowering plants in the beds at the Experimental Farm.

In greenhouses the insect which is doing most damage at the present time is the Greenhouse Leaf-tyer (*Phlyctaenia ferrugalis*). This has done a good deal of injury in one large house, the chief damage being to chrysanthemums. The Variegated Cutworm (*Peridroma saucia*) is occasionally destructive in greenhouses. At the present time the caterpillar is attacking carnations in one house, climbing up the plants and eating out the contents of the buds.

Division No. 3, Toronto District—A. Cosens.

The season of 1912 has been rather a disappointing one to the Entomologist. Not only did the cool weather, in the case of several species, prevent a large number of insects from reaching maturity, but the excessive rainfall gave to the observation and collection of specimens somewhat the character of an aquatic pastime.

Some insects, however, seem to have prospered unusually well either on account

of or in spite of the inclement season. In this vicinity, from about May 10th to the present date, September 23rd, the Red Admiral butterfly (*Pyrameis atalanta,* Linnæus) has been unusually plentiful. It has not appeared in nearly such large numbers since the year 1905. A number of specimens were examined during May, and practically all of them were brightly coloured, and seemed to have recently emerged from the chrysalids. In comparison, only a few were doubtfully classed as hibernating forms. No doubt many factors, few of which are yet understood, control the production of each species of butterfly, but in all probability parasitism plays the chief role. This will account for a season with numbers above the average being succeeded by one with correspondingly low numbers in the same species, the year of plenty having produced ideal conditions for the increase of the parasites. During the season fewer specimens than usual were seen of the other species of butterflies, with perhaps the exception of the Viceroy (*Basilarchia archippus,* Cramer).

The "Spittle Insects," Fam. Cercopidae, were also very numerous. During July, in low-lying land, nearly every specimen of Red Top (*Agrostis alba var. vulgaris,* Thurb.) carried a mass of froth, indicating the presence of either the larva or pupa of the insect. With the purpose of testing the froth for the enzyme diastase, a large number of the masses were washed off into distilled water. The froth remained separate from the water until toluol was added; this seemed to alter the

Fig. 11.—Grape Vine Leaf-hopper.

surface tension, and the froth passed into solution. A small quantity of this solution was then placed in about an equal amount of starch paste, made of cornmeal, and left for a few hours. A test with Fehling's solution then showed that a comparatively large amount of the starch had been changed to sugar. Without further investigation it is rather premature to surmise the purpose of this sugar-producing enzyme, but it seems possible that it may have a pre-digestive effect on the starch of the host and thus convert it into a more soluble form for the use of the larva. Experiments, not yet complete, seem to indicate that stems, surrounded by the froth masses, do contain more sugar than an equal weight of unaffected stems.

Another species in the same family also appears to have been influenced favourably by the vagaries of the season. Dr. Walker has informed me that the Grape Vine Leaf-hopper (*Typhlocyba comes*) was very plentiful on the Boston Ivy (*Ampelopsis veitchii*). The leaves on which the insects were feeding had become pale and blotchy in appearance.

The Elm Bark Louse (*Gossyparia spuria,* Mod.) has not proven as serious a pest here as was apprehended on its first appearance. It now seems to be practically absent from certain streets, the trees of which were badly infested a couple of years ago. While it has killed some very small introduced elms, it has not injured the larger specimens materially, and the indigenous *Ulmus americana,* L., is not often attacked by it. Specimens of the Coccid (*Kermes pubescens,* Bogue) were not numerous this season. This insect causes a marked swelling and distortion of

the petioles and young twigs of its host, *Quercus alba,* L. In some cases these deformities are decidedly gall-like in character. Sections of these show an enlargement of the cells of the host without proliferation of the tissues. Not a single specimen of the Coccid (*Kermes galliformis,* Riley) was found during the year.

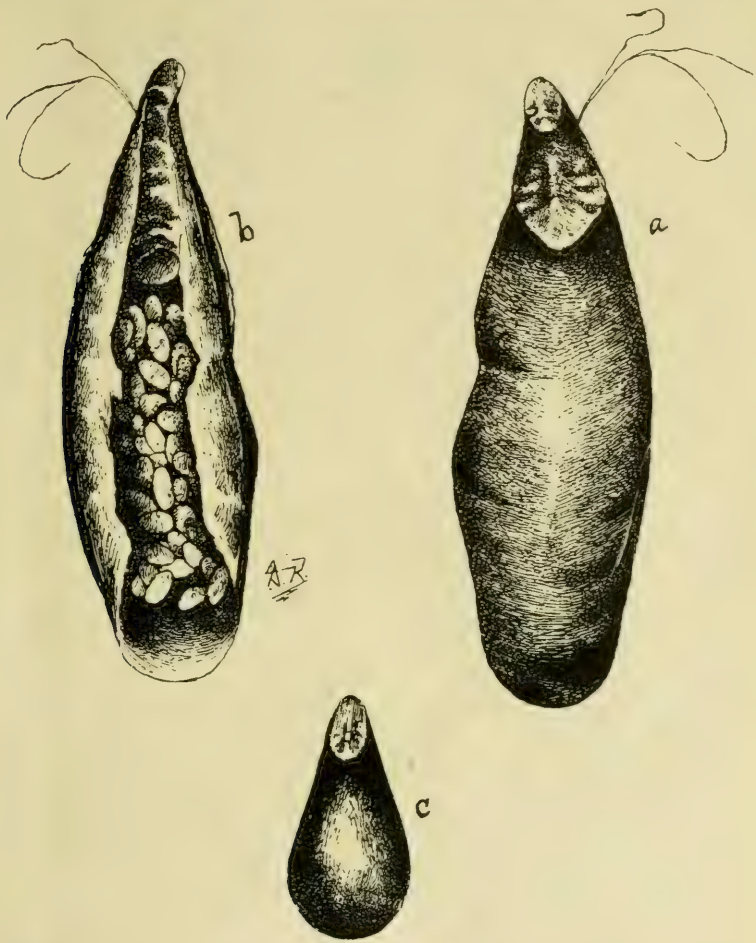

Fig. 12.—Oyster-shell Scale (*Lepidosaphes ulmi*): (*a*) Adult female, back view, showing the two moulted skins at anterior end, and the bristles of the sucking tube; (*b*) Adult female, turned over, showing the insect at the anterior end and the eggs at the posterior end; (*c*) Adult male scale, much smaller than female, with one moulted skin at anterior end.

The small moth, *Euclemensia bassettella,* Clemens, appears to be checking the scale in this locality almost to the point of extinction. In former years, an average of about 25% of the specimens were found to be parasitized by this insect. In the apple orchards near the city the Oyster-shell scale (*Lepidosaphes ulmi,* Linn.) is

apparently becoming more destructive each year. This is probably due to the fact that little new stock has been set out, and the powers of resistance of the old trees are gradually diminishing. Further, diseased and useless trees are almost invariably left to act as breeding places for the insects and centres from which young stock can be infected.

Fig. 13.—Piece of Branch infested with Oyster-shell Scale.

REPORT OF THE COUNCIL.

The Council of the Entomological Society of Ontario begs to present its report for the year 1912-13.

The Forty-eighth Annual Meeting of the Society was held at the Ontario Agricultural College, Guelph, on Thursday and Friday, November 23rd and 24th, 1911. There were eight members present from a distance, as well as a large attendance of the faculty and students connected with the College.

During the first afternoon, the reports of the Directors on the insects of the year were read and discussed; papers were read by Dr. G. G. Hewitt on "Some Work of the Division of Entomology in 1911;" by Mr. L. Cæsar on "Insects of the Year in Ontario," and by the Rev. Dr. T. W. Fyles on "Notes on the Season 1911." Reports were read from the Montreal Branch, the Toronto Branch, the Librarian, Curator, and Delegate to the Royal Society.

In the evening a public meeting was held in the Massey Hall auditorium, which was well attended by members of the Society, students of the College and the Macdonald Institute, and visitors from the town. Dr. C. G. Hewitt gave a most interesting address on "Insect Scourges of Mankind," which was illustrated by many excellent lantern-slides. The chair was occupied by President Creelman of the College.

On the following day the Society met in the Museum of the Biological Department, where many interesting specimens were exhibited by the members. The Annual Address of the President, Dr. Walker, was then read, after which the election of officers for the ensuing year took place. In the afternoon the following papers were read: "Some Injurious Forest Insects at De Grassi Point, Lake Simcoe," by Dr. E. M. Walker; "Thrips Affecting Oats," by Dr. C. G. Hewitt; "The Stream," by Dr. T. W. Fyles; "A Hymenopterous Parasite of Hepialus thule," by Mr. A. F. Winn; "Injurious Insects of the Year, Macdonald College, Quebec," by

Mr. J. M. Swaine; "Insect Migration at Aweme, Man.," by Mr. Norman Criddle; "The Catalogue of Canadian Insects," by Dr. Hewitt; "Some Notes on Hepialus hyperboreus," by Mr. Horace Dawson; "Blister Beetles" and "The Entomological Record for 1911," by Mr. A. Gibson.

The Canadian Entomologist, the monthly journal of the Society, has been issued regularly each month. The forty-third volume was completed in December last; it consisted of 429 pages, and was illustrated by four full-page plates and many original drawings. The contributors numbered 59, and included writers in Ontario, Quebec, Manitoba, Alberta, Australia, many States of the Union, and the Hawaiian Islands.

Meetings of the Society were held during the winter months of 1911 and 1912 in the Biological Lecture Room of the Ontario Agricultural College. Before Christmas the meetings were held on alternate Thursday afternoons, and after New Year's joint meetings were held with the Wellington Field Naturalists' Club, weekly. The meetings were well attended by the staff and students of the Ontario Agricultural College and interested citizens of Guelph. The first meeting was devoted to observations by the various members, and during the rest of the season the following papers were read in order:—

"Observations in Algonquin Park," Prof. J. E. Howitt.
"Foul Broods of Bees," Mr. G. L. Jarvis.
"The Nursery Question," Mr. L. Cæsar.
"Mosquitoes," Mr. C. A. Good.
"The Economic Importance of Calosoma sycophanta," Mr. J. Noble.
"Insect Intruders in Indian Homes," Mr. G. J. Spencer.
"Birds in Relation to Insects," Mr. E. N. Calvert.
"Fall Collecting of Coleoptera," Mr. A. W. Baker.
"Insectivorous Birds," Professor T. D. Jarvis.

The reports of the Branches of the Society at Montreal and Toronto give evidence of much active work, meetings having been regularly held, and many papers read and discussed. It is with great satisfaction that the Council reports the renewal of activity of the British Columbia Branch, which has already outnumbered the other branches in the list of members, and is doing much valuable work.

The Council has to record with sorrow the death of one of America's foremost entomologists, Dr. J. B. Smith, who died of Bright's disease, on March 12th, 1912. Besides a number of important monographic works on various families of Lepidoptera, particularly the Nocuidæ, Dr. Smith was the author of several very excellent popular treatises on Economic Entomology, in which subject few men were his equal. His contributions to the Annual Reports of the New Jersey Agricultural Experiment Station, and his many economic bulletins are of the greatest value, and he is also widely known for his masterly work on the control of mosquitoes. He was an Honorary Member of the Entomological Society of Ontario and of many other learned societies, which have thus recognized the eminence of his scientific attainments.

It is also with profound regret that the Council has to record the loss of one of our Society's most active and enthusiastic members, the Reverend G. W. Taylor, who died of paralysis at Nanaimo, B.C., on August 22nd, 1912. Mr. Taylor was widely known for his work in Marine Zoology, in recognition of which the Dominion Government in 1905 appointed him a member of the Dominion Fisheries Commission for British Columbia. He was no less eminent in Entomology, as a student of the Geometridæ, and was a frequent contributor to the pages of the *Canadian Ento-*

mologist. He was also a Fellow of the Royal Society, and of the Zoological and Entomological Societies of England, and Corresponding Member of the Ottawa Field Naturalists' Club. Much of his character and personality is conveyed in the following words of the late Mr. James Fletcher: "Mr. Taylor is an indefatigable collector and a generous correspondent, who considers no trouble too much to make observations or secure specimens when specially desired. In his parish work he is painstaking, gentle and self-denying—always ready to help. A clear and forcible preacher and an earnest liver, who shows in his works that religion is not an accessory of everyday life, but an integral part of it."

Respectfully submitted,

E. M. WALKER,
President.

ANNUAL REPORT OF THE MONTREAL BRANCH.

The 328th regular and 39th annual meeting of the Montreal Branch of the Entomological Society of Ontario was held on May 8th, at the residence of the President, Mr. G. A. Southee, 356 Durocher Street, Outremont.

The following report was read by the Secretary:—

THIRTY-NINTH ANNUAL REPORT OF THE COUNCIL.

During the season 1911-12 eight meetings have been held, the average attendance being 7½. A meeting of Council was held in September to arrange a programme for the winter's meetings, which unfortunately could not be carried out. The following papers and addresses were given at the meetings:—

Address of Retiring President, Henry H. Lyman.
Some Effects of the Hot Summer on Insect Life, A. F. Winn.
Tachinid Parasites of Gypsy and Brown-tail Moths, J. D. Tothill.
Notes on Hepialus Hyperboreus, Horace Dawson (read by Secretary).
Little Journeys to Homes of Entomologists, H. H. Lyman.
Report on Annual Meeting at Guelph, A. F. Winn.
The Stilt Bugs, G. A. Moore.
The Catch from Dawson, Y. T., 1911, L. Gibb.
Further Notes on Types in British Museum, H. H. Lyman.
An Account of Visits to some U. S. Collections, F. H. Wolley-Dod.
A Miniature Insectary, A. F. Winn.
Sexual Differences in the Hemiptera, G. A. Moore.
The Determination of Sex in Lepidoptera, A. F. Winn.
Rye's Newest Moth (*Gortyna erepta*), Henry Bird (read by Secretary).
List of Lepidoptera from Yukon Territory, A. F. Winn.

We were again fortunate enough to have visiting entomologists at two of our gatherings, Mr. J. D. Tothill at the October one, and Mr. F. H. Wolley-Dod, of Calgary, in January, and both these gentlemen kindly addressed the meetings.

To the Library has been added a copy of Colonel Casey's Memoirs on Coleoptera, Parts I.—III. Owing to Mr. Gibb having left the city to reside in London, England, the cabinet has been temporarily removed to Mr. Lyman's residence.

A case of butterflies and moths has been prepared by Mr. Gibb for Lower Canada College, and, it is hoped, will interest some of the boys in the wonders and beauty of insect life.

The Branch is badly in need of additional members to share the work of keeping up the interest in our meetings and bringing specimens, notes and queries. An effort should be made to encourage boys who are inclined to hobbies of collecting to take up some group of insects.

Copies of several new works on Lepidoptera were shown at the meetings.

The report of the Treasurer shows a balance on hand of $74.98.

Respectfully submitted, on behalf of the Council,

A. F. Winn,
Secretary.

The chairman delivered his annual address, after which the election of officers for the ensuing year was proceeded with, resulting as follows: President, G. A. Southee; Vice-President and Librarian, G. Chagnon; Secretary-Treasurer, A. F. Winn; Curator, H. H. Lyman; Members of Council, G. A. Moore, E. C. Barwick, and L. Gibb.

The Secretary showed a box containing a series of about 30 specimens of *Colias philodice* to illustrate how interesting a representation of the varieties of a common butterfly may be.

Mr. Southee also exhibited a number of drawers of Lepidoptera.

The meeting then adjourned.

G. A. Southee, *Pres.* A. F. Winn, *Secretary.*

ANNUAL REPORT OF THE TORONTO BRANCH.

The 169th regular and 16th annual meeting of the Toronto Branch was held in the Biological Building, on Thursday, October 10th, the President, Dr. Walker, in the chair.

The annual report of the Secretary-Treasurer was read and approved. In the course of the year eight meetings were held; the average attendance was seven. Four new members were elected. The following papers were read:—

Nov. 9.—A Cosens, "Some Insects of the Season."
Dec. 14.—Dr. Walker, "Notes on Insects of the Season at De Grassi Point."
Jan. 11.—J. B. Williams, "Recent Theories on Mimicry."
Feb. 15.—C. W. Nash, "Insects in a City Garden."
Mar. 14.—Arthur Smith, "Insects in Folk-lore."
May 2.—Dr. Walker, "Work of Some Common Longicorns."
May 16.—Dr. Abbott, "Respiration of Birds and Insects."
June 14—A. Cosens, "Feeding Habits of the Cynipidæ."

The officers elected for 1912-13 were as follows: President, A. Cosens; Vice-President, Dr. Walker; Secretary-Treasurer, E. H. Craigie, 40 Leopold Street; Librarian, J. B. Williams; Council, Dr. Abbott, Messrs. P. Hahn, A. M. Patterson, S. T. Wood.

Respectfully submitted,

Arthur Smith, *Secretary.*

ANNUAL REPORT OF THE BRITISH COLUMBIA BRANCH.

The British Columbia Branch of the Ontario Entomological Society was reorganized on December 9th, 1911, after having lain dormant four or five years previous to this date. The following officers were elected: Hon. President, Rev. G. W. Taylor; President, Tom Wilson, (formerly Vice-President); Vice-President, G. O. Day, F.E.S.; Secretary, R. C. Treherne, B.S.A.; Advisory Board, Tom Wilson, G. O. Day, R. C. Treherne, W. H. Lyne, R. S. Sherman, and J. R. Anderson.

An excellent programme was arranged at the reorganization meeting, a copy of which was duly forwarded to Ontario and afterwards printed in the Annual Report of the Ontario Entomological Society, 1911.

A general summary of the papers was also forwarded at the same time and printed in the same report.

There is every intention to hold another meeting in a short time from now, the programme of which is at present in process of formation.

I am glad to say that the membership of the British Columbia Society has increased from about 24 to nearly 40 in the past year. A small bulletin was printed at the close of the meeting in December, 1911, and this has been freely distributed over the Province, with the result that a number of fruit-growers and farmers have become interested and have duly become members by payment of the annual subscription of $1.00.

Until a very short time ago it was intended to hold the annual meeting in Vancouver early in December of every year, but owing to the great distances members have to travel and the limited means of transportation in the Province, it has been deemed advisable to hold the meeting in January. It has not been definitely settled, but it is very probable that the annual meeting of the Society will be held in Victoria on the 9th and 10th of January during the week of the Agricultural and Horticultural Conventions. During this week delegates of the Fruit Growers' Association and members of Farmers' Institute meet together to discuss matters of interest. Consequently it would seem more desirable to hold the meeting then than in December, when such members as would be present can only be recruited from those living in the immediate vicinity of the point of meeting.

If this arrangement is acted upon, there will be no report from the British Columbia Branch from this Fall, or for publication in the Year 1912.

It would seem more desirable to meet in January of 1913 and forward the report of that meeting to the Ontario Society for presentation at their Fall meeting in 1913.

During the past year the British Columbia Society has been entirely financed by private subscriptions, all expenses of correspondence, of meeting and of publication of the small bulletin on the proceedings has been thus met. No Provincial grant has been allowed for maintenance thus far, but in view of the interest which the small bulletin created and is likely to create, it is to be hoped that a small Provincial grant will in time be forthcoming.

Respectfully submitted,

R. C. Treherne, *Secretary.*

CURATOR'S REPORT.

During the past year very few insects have been added to the Society's collection, but for this year we have the promise of a good number of specimens that are much needed, if the collection is to be at all representative of all the orders. We are at present very lacking in Diptera and Hymenoptera, but especially in Diptera. Any member who can spare named specimens of this order would be conferring a great favour.

The collection has been examined from time to time throughout the year, and the necessary measures taken to keep it in good condition.

Respectfully submitted,

L. Caesar, *Curator.*

THE REPORT OF THE LIBRARIAN.

During the year ending October 31st, 1912, forty-seven bound volumes have been added to the Library, making the total number on the register 2,153.

Work on the card catalogue has been continued, and some further progress made. Much, however, remains to be done before there is a complete index to subjects.

The trustees of the British Museum, London, England, have very kindly presented the following books:—

"Monograph of the Culicidæ of the World," by F. V. Theobald, Vols. III and V.
"Synonymic Catalogue of Orthoptera," by W. F. Kirby, Vol. III.
"Illustrations of Lepidoptera," Parts VI. and IX., 4 Vols., quarto.

Among other additions to the Library may be mentioned the following:—

Newstead's "Monograph of the British Cœsidæ" in 2 vols.
Sanderson's "Insect Pests of Farm, Garden and Orchard."
Sanderson & Jackson's "Elementary Entomology."
Dr. Walker's "Monograph of the Genus Æshna (Odonata)."
Hugo de Vries' "Works on Mutation and Variation," 5 vols.
Enrio Reuter's "Palpen der Rhopaloceren" and "Morphology et Ontogenie der Acariden," 2 vols., quarto.
Comstock's "Spider Book."
Mrs. Comstock's "Handbook of Nature Study."

The Library continues to be much used by the Biological students and staff of the Ontario Agricultural College, and is of great assistance to them in their scientific pursuits.

Respectfully submitted,

Charles J. S. Bethune, *Librarian.*

REPORT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO TO THE ROYAL SOCIETY OF CANADA.

Rev. Thomas W. Fyles, D.C.L., Ottawa.

The Entomological Society of Ontario has of late years had its offices in the Ontario Agricultural College at Guelph. In that institution it enjoys many privi-

leges, and has abundant opportunities for impressing the agricultural students and teachers-in-training with the importance of Nature Studies. There is its very valuable library, and its extensive collections of biological specimens. One of the founders of the Society, the venerated Dr. Bethune, is Professor of Entomology and Zoology on the College staff.

The Society held its forty-eighth annual meeting on the 23rd and 24th of November last, under the presidency of Dr. Edmund M. Walker, Lecturer in Zoology in the University of Toronto. The following is a list of the subjects brought under the notice of the meeting. The papers will appear in full in the forthcoming Annual Report of the Society:—

REPORTS ON THE INSECTS OF THE YEAR:

Division 1. Ottawa District, Arthur Gibson.
Division 2. Orillia District, C. E. Grant.
Division 3. Toronto District, A. Cosens.
Division 4. East Toronto, C. W. Nash.
Division 7. Niagara District, R. C. Treherne.
"Some Work of the Division of Entomology," C. G. Hewitt.
"Insects of the Season in Ontario," L. Cæsar.
"Notes on the Season of 1911," T. W. Fyles.
"Insect Scourges of Mankind," C. G. Hewitt.
Annual address of the President, E. M. Walker.
"Some Injurious Forest Insects at De Grassi Point, Lake Simcoe," E. M. Walker.
"Thrips Affecting Oats," C. G. Hewitt.
"The Stream," T. W. Fyles.
"Blister Beetles," A. Gibson.
"A Hymenopterous Parasite of Hepialus Thule," A. F. Winn.
"Injurious Insects of the Year, Macdonald College, Ont," J. M. Swaine.
"Catalogue of Canadian Insects," C. G. Hewitt.
"Some Notes on Hepialus Hyperboreus," H. Dawson.
"The Entomological Record," A. Gibson.

The *Canadian Entomologist,* the Society's monthly organ, has now reached the 44th year of its publication. The volume for 1911 contains 429 pages. It is illustrated with 4 plates, and 28 figures in the text. Its contributors were 59 in number, one each from Honolulu, Hawaii, and Brisbane (Australia), and the remainder from various parts of Canada and the United States of America.

Many new species are described in the volume, and much information is given on the distribution, habits, and life histories of insects in all orders.

Reviews of books and pamphlets of recent issue have been given promptly, thus calling attention to the work of Entomologists outside of the sphere of magazine articles.

The whole respectfully submitted,

THOMAS W. FYLES.

ANNUAL ADDRESS OF THE PRESIDENT.

EDMUND M. WALKER, B.A., M.B., TORONTO.

I have the honour of welcoming you to the 49th Annual Meeting of the Entomological Society of Ontario and the sixth meeting held at Ottawa.

It is nine years since one of our annual meetings has been held at a distance from the Society's headquarters in Guelph, and although we regret that many of our Guelph friends are unable to be with us on this occasion, we rejoice to see the faces of other members who would have found it impossible to attend the meeting had we

met elsewhere than in Ottawa, and we greatly appreciate the kindness of our Ottawa friends, who have spared no efforts to make our visit a pleasant and interesting one.

It is good for us, and for the welfare of our Society, to change our place of meeting from time to time. It will give to many who would otherwise find it difficult to attend our meetings, the opportunity of doing so, and to our Society itself and the aims and objects of its work, it will help to give more of that public recognition which they undoubtedly deserve.

It has usually been the custom on these occasions for the President to review the work of the year, or to discuss the recent progress of our science; but I find that this rule has not been strictly observed, and I feel, therefore, that I am not violating a time-worn custom in departing from this practice and speaking to you for a little while upon a subject which has as yet received but little attention in Canada, but which should, I think, be of some interest to all entomologists.

The Faunal Zones of Canada.

I refer to the geographical distribution of insects in our country, or rather to that of the Canadian fauna in general, for the greater part of Canada is still almost a *terra incognita* from an entomological standpoint, and it is therefore a necessity to refer also to other groups whose distribution is better known than that of the insects, in order to form a definite idea of the faunal areas into which our country is divided.

We have all seen the map of the Faunal Zones of North America, which was published in the May number of our magazine, and no doubt all who have seen it realize in a general way that the differently coloured areas represent zoological zones, and that the fauna of each zone has certain particular characteristics. But, as far as I am aware, no explanation of these characteristics has appeared in any entomological publication, so that it may not be without interest to consider the map for a little while, particularly as this map is to be used in connection with the catalogue of Canadian insects, the distribution of each species being referred to under the names of the various zones inhabited by it.

Some facts of zoogeography are familiar to all. Everyone knows that countries of widely different climatic conditions differ more or less widely in their plant and animal inhabitants, and that, generally speaking, localities remote from one another also exhibit marked points of distinction in their flora and fauna. A very little observation, however, will show that many other factors besides those of climate and distance are concerned in the distribution of life. Thus, zoologically, there is more difference between Australia and New Zealand than there is between England and Japan, and more between the Pacific slope in British Columbia and the foothills of the Rockies than between Labrador and the Mackenzie River country. Barriers of any kind, such as seas, mountain chains, deserts, etc., if sufficient to prevent free communication between the faunas of adjacent districts, are invariably associated with more or less marked differences in the faunas thus separated. The degree of difference depends in large measure upon the length of time during which the faunas have been separated, so that here again we have another factor, the historic factor, *i.e.,* the geological history. Indeed, the present distribution of animals is chiefly the outcome of their geological history. Now, geologists have shown that the various classes of animals now living are of different ages, some of much more recent origin than others. Their dispersal over the earth's surface has thus taken place at different periods of the earth's history, so that this present distribution has been influenced in various ways by their past history. Then again, the means of dispersal possessed by animals is almost unlimited in its variety, and is another important factor in deter-

mining the distribution of the species. The water-snails are largely dependent upon the river system that they inhabit, different river-systems usually have distinctive faunas, while terrestrial forms are practically uninfluenced by this factor. Strong, high-flying insects and birds will not be deterred by many barriers that would be prohibitive to flightless forms and weak fliers.

For such reasons of these it is impossible to construct a map of the zoological regions of the world or of any country that will suit all groups of animals equally well. There have been, however, certain events in the world's history that have had a vast effect on the distribution of life in general over immense areas of land. As far as Canada is concerned, the great geological events of comparatively recent date have been the Ice Age and the existence of former land-bridges connecting North America with Asia and Europe.

The existence of a land-bridge across Bering's Sea in early Glacial times is supported by many facts of geology and zoogeography. The close resemblance between the fauna and flora of North-western North America and North-eastern Asia has often been remarked upon, and it is generally admitted that a large proportion of the species of both plants and animals inhabiting the North-west originally came from Asia over this land-bridge. Many of these species have since spread eastward and now range across the continent, but the number of such species is noticeably greater in the West, particularly in Alaska, than elsewhere. It is noteworthy, too that such species, among the mammals at least, are absent from Newfoundland, which was separate from the continent even at the time of the invasion of animals from Asia. Thus the moose, wapiti and barren-ground bear, which are of Old World stock, range across Canada, but do not occur in Newfoundland, while the mountain sheep, whose nearest relatives are also Asiatic, do not range east of the Rockies, even as a fossil. The same is true of the butterflies of the genus Parnassius and many other insects..

The existence of a land-bridge connecting North America and Europe by way of Greenland, Iceland and Scotland, is also supported by the fact that the fauna and flora of Greenland are mixtures of American and European species, some of the latter, such as the European garden-snail, *Helix hortensis,* ranging down the east coast of North America as far as Maine, but not penetrating westward. The noctuid moths, *Anarta schoenherri* and *A. lapponica,* occur in Scandinavia, Greenland and Labrador, while *A. melanopa* is found in Colorado, the White Mountains, Labrador, Scandinavia, Scotland and the Alps.

These former land connections existed at a time when conditions were more favourable for life in the north than they are at the present time. Hence a large number of species, which formerly inhabited the far north have since been driven southward into more hospitable latitudes, and no longer occur in the Arctic regions.

On the other hand, there is no doubt that, at some time in the past, arctic conditions as we now understand them existed much farther south in North America than they do at the present time. We find isolated remnants of arctic and subarctic faunas and floras hundreds of miles to the south of their present general area of distribution. The summit of Mount Washington supports a number of species of plants and animals which occur elsewhere only in the Arctic regions. *Oeneis semidea* is the classical example among insects. The White Mountain colony of this butterfly is separated by a thousand miles from its nearest brethren in Labrador.

The presence of these southern remnants of the Arctic fauna and flora is usually attributed to the influence of the Glacial Period. This was a period during which it is commonly believed that almost the whole of the northern half of North America as well as a large part of Europe and Asia became covered with an almost continuous

sheet of ice, and that the fauna and flora of the region thus covered were either exterminated or pushed southward by the advancing ice-sheet. On the final retreat of the ice-sheet northward to the Arctic regions, the country was repopulated with life from the south, chiefly from those species which had been driven southward during the period of advancement. First came the Arctic fauna and flora, followed by those of the succeeding life-zones, until the present distribution of life was established. During the northward movement remnants of the arctic and subarctic faunas were left behind wherever the conditions were suitable for their existence, such as on mountain-tops, in cold bogs, etc.

This view is very plausible, but there is much biological evidence to show that the fauna and flora of the glaciated regions never occupied the country south of the drift or glaciated area, and that the climatic conditions in this area were more favourable for the existence of life during the so-called Ice Age than they are at present.* The existence of glaciers does not depend upon intense cold, but chiefly upon a copious precipitation in the form of snow, which, of course, requires a fairly low temperature in the region where the glacier is formed, but also demands a considerable degree of warmth in the surrounding country. The glaciers of Alaska occur chiefly in the warmest part, the southern shore, whereas the cold interior is devoid of them. The extensive glaciers of the Ice Age were probably due to the presence of the land-bridges connecting North America with Europe on the east and Asia on the west. The Arctic Ocean was thus isolated, and the temperature of the Atlantic and Pacific considerably elevated, thereby modifying the climate of the Arctic regions on both sides of the continent and bringing about the conditions necessary for the formation of glaciers.

Species such as the snail *Helix hortensis* and the wood-louse *Oniscus asellus,* whose entrance into North America is traceable to the north-eastern land-bridge from Europe, have not yet reached the higher parts of the White Mountains, though they occur in Northern New England, and the origin of the Arctic element in the fauna of the White Mountains is probably of much earlier date than the Glacial Period. There is no doubt, however, that the presence of these relics of the Arctic fauna does indicate that at some period an Arctic climate did prevail over a large part, if not the whole, of Canada, and the Northern States, and that, with the gradual increase of temperature which followed, species adapted to a colder climate were exterminated or driven northward, stragglers remaining behind wherever conditions were favourable to their existence. These isolated colonies of northern forms occur not only at high altitudes, but also to a smaller extent at quite low levels, *e.g.,* in bogs, where the soil is wet and poorly drained, and thus colder than the surrounding country. Such restricted areas, inhabited by northern species, are termed "boreal islands."

Let us now turn our attention to the map of the faunal zones of North America.

This map was prepared by the U. S. Biological Survey, and is mainly the work of Mr. C. Hart Merriam, an eminent authority on the Mammalia, upon the distribution of which the map is chiefly based. Perhaps the first thing on it that is apt to strike our attention is the transverse arrangement of the zones across the continent. This is because the factor of temperature has been regarded as the controlling one in defining the distribution of the Mammalia. It has been remarked by several zoologists, however, that laws of temperature control do not define transcontinental zones of primary importance zoologically. They emphasize the secondary, not the primary facts of distribution. Thus, in our map, we have

*See R. F. Scharff, "Distribution and Origin of Life in America," London, 1911.

California and Mexico divided into the same zones as the Atlantic State, in spite of vast and important differences in their fauna and flora. In regard to temperature, these zones are comparable in the east and west, but in little else. They would be more properly regarded as homologous subdivisions of quite different zoogeographical provinces. For the purpose of our catalogue, however, in which we indicate the distribution of species by reference to political divisions, as well as to faunal zones, the map is a convenient one and probably better suited to the purpose than any other map as yet published.

It may, therefore, be of interest to examine the map for a little while and consider the characteristics of the various zones.

The continent of North America is seen to be divided into two main regions, a northern or Boreal Region and a southern or Austral Region. The Boreal Region includes the greater part of Canada as well as the northern parts of Europe and Asia, and gives off southern extensions along the mountains on both sides of the United States; the Austral Region occupies the greater part of the United States, part of Mexico, and a small part of Canada. Part of the Tropical Region is also included on the map, embracing Central America, the West Indies, and parts of Southern Mexico and Southern Florida.

The Boreal Region in North America is divided into three zones: the Arctic, Hudsonian and Canalian Zones. The Arctic Zone is the region north of the limit of trees, including the Barren Grounds or Tundra of North America and Siberia. It is also represented upon the mountains farther south, wherever these are elevated above the tree-line.

The plants and animals of this region, particularly of the truly arctic portions, are largely circumpolar, or represented by very nearly allied species in the northern parts of Europe and Asia.

This is due to the free communication that formerly existed between these regions by means of the land-bridges already mentioned. The mammalian fauna includes a number of species peculiar to this zone, such as the polar and barren-ground bears, musk ox, barren-ground caribou, arctic fox, arctic hare, lemming, etc. Not much is known of the insects, but mention may be made of the satyrid butterflies of the genera Oeneis and Erebia, the dwarf fritillaries of the genus Brenthis, certain species of Colias, the noctuid moths of the genus Anarta and the grasshopper *Melanoplus borealis,* a near relative of our common red-legged grasshopper. There are also some charteristic beetles, besides many species of various orders which also occur farther south.

South of the Arctic Zone is an immense belt of coniferous trees, stretching obliquely across the continent from Nova Scotia, Newfoundland and Labrador to the Northern parts of the Great Lakes and Hudson Bay, and thence northward of the Great Plains to the Pacific Coast, extending north-westwardly to the Mackenzie River Basin and southwardly into the north-western United States, where it is continued along the mountains as a series of irregular, more or less broken areas. It is also continued southwardly along the Appalachians to North Carolina. This great forest region comprises the other two faunal zones of the Boreal Region, viz., the Hudsonian and Canadian Zones.

The Hudsonian Zone is a region of more or less scattered and stunted trees, occupying the northern part of the Boreal Region. It is a transitional region between the treeless Arctic Zone and the densely forested belt south of it, which constitutes the Canadian Zone. Except towards its southern boundary and in its mountainous western portions, this forest belt is composed of only eight species of

trees, the black and white spruce, jack-pine, tamarack, balsam fir, paper birch, balsam and aspen poplar. Other species of trees as well as other plants and animals appear in the west, particularly on the Pacific Slope, this part of the country belonging, properly speaking, to a different faunal region, as will be explained more fully later. Except for this western section, however, the Canadian and Hudsonian Zones are remarkably homogenous throughout their entire extent, both in their flora and fauna and, like the arctic zone, though to a relatively smaller extent, they share many genera and even species with the northern parts of Europe and Asia.

These two zones form a region of muskegs, peat-bogs and countless lakes of poor drainage, and the bog-plant society, composed of such plants as sphagnum-moss, sundews, pitcher-plants, cranberries, and other heath-plants, are very characteristic. It also constitutes the great fur-bearing region of North America, and among its characteristic mammals are the moose, woodland caribou, wapiti, black bear, Canada lynx, pine marten, etc. In the west we have also the various species of mountain sheep, the mountain goat, and the grizzly bear.

The butterfly genera mentioned as characteristic of the Arctic region also occur commonly here, together with a number of other forms, among which are several of our commoner members of the Vanessa group, such as *Euvanessa antiopa, Aglais milberti, Eugonia j-album, Polygonia faunus, P. progne,* and *Vanessa cardui.* All of these occur also in the Old World, or are represented by nearby allied species. The dragonflies of this region are also very closely related to those of Northern Europe, nearly all of the genera and several species being common to both hemispheres. The most characteristic genera are *Cordulia, Somatochlora,* and *Leucorrhinia,* the first two consisting of beautiful, swift-flying forms of dark metallic greenish coloration with emerald green eyes, the latter of smaller black species, with black and yellow bodies and pure white faces. The little red dragonflies of the genus Sympetrum and the large blue and green spotted forms belonging to the Aeshna are also very abundant in this zone. All these genera are represented in Europe and Asia by closely allied species. Leconte has also pointed out similar characteristics in the Coleoptera, and it is also true, though to a less extent, in the Orthoptera, and probably in a greater or less degree of all the orders of insects as well as of other classes of animals.

Whereas the forests of the Boreal Region are of the coniferous type, those of the Austral Region are of the broad-leaved or deciduous type, comprising the oaks, maples, elms, hickories, etc. This region also includes three zones, the Transition, Upper Austral, and Lower Austral. It is also divided into an eastern or humid section and a western or arid section. In the opinion of many zoologists, these eastern and western sections represent different faunal centres of distribution and should not be united into one region. Certainly among the insects there is much to support this view. In the Orthoptera, for instance, there are many genera and hosts of species in the dry arid parts of the Western Plains and the Pacfic Slope which have no near relatives in the east, and there are many eastern forms whose area of distribution ends at the Rocky Mountains or which are confined to the wooded country east of the Great Plains.

Similar statements may be made of the beetles, butterflies and dragonflies, and, in fact, of the Class Insecta in general. Many species seem to have had their origin in the south-western states or in Mexico and to have spread from this centre of distribution to the north and east.

Of the Upper Austral Zone only a very small portion of the humid section or

Carolinian Zone is represented in Canada. This is a strip of territory along the North Shore of Lake Erie from the Niagara to the St. Clair River. The mild climate of this district is due to the modifying influence of the Great Lakes by which it is partly enclosed. Here we have a fauna and flora more like that of Northern Ohio and Southern Pennsylvania than that of most parts of Canada. The coniferous trees form a very small part of the forest growth, while the deciduous trees include many species not found in a wild state in any other part of the country, such as the tulip, chestnut, sycamore, walnut, papaw, sassafras, a number of oaks and hickories, and, on Pelee Island, the honey-locust and the Kentucky coffee-tree. The same is true of the fauna and notably so of the insects, for so many of these are dependent on particular food-plants. Among the butterflies, *e.g.*, there are several Papilios which are practically restricted to this Zone, viz., *P. thoas, ajax, troilus* and *philenor,* and other species such as *Zerene caesonia, Eurema lisa, Euptoieta claudia, Basilarchia astyanax* and *Junonia caenia.* Many species of moths, notably among the genus Catocala, are also restricted to this section of Ontario. The Orthoptera show a great increase in number of species here as compared with other parts of Ontario. The green grasshoppers and katydids are particularly numerous. Eight species of Orchelimum and five of Xiphidium occur here, whereas north of Toronto only one species of Orchelimum and two of Xiphidium occur. The true Katydid (*Cyrtophyllus perspicillatus*), the Oblong-winged Katydid (*Amblycorypha oblongifolia*), the Mole-cricket (*Gryllotalpa borealis*), the Shield-back Grasshopper (*Atlanticus pachymerus*) and many other species occur nowhere else in Canada except here. Other orders of insects are similarly represented by numerous additional species, while there is an absence of many of the forms that are common in the northern coniferous forests. North of the Upper Austral Zone we pass into the Transition Zone, which is simply the territory where the Boreal and Austral Regions overlap and there is an intermingling of types from both regions.

The humid or eastern division of this zone is also known as Alleghanian Zone. It includes parts of Nova Scotia and New Brunswick, a small part of southern Quebec and the greater part of Old Ontario. The forests are mixtures of the deciduous and coniferous types. The oaks and hickories are greatly reduced in variety, the prevailing hardwoods being the maples, elms, beech, birch, and basswood. Hemlock, red and white pine and white cedar are also abundant. In the southern part of the Transition Zone we find extensions of the more restricted austral fauna and flora in sheltered localities, such as river valleys and southern slopes, and it is often in such places that we find the northern limits of austral types. Thus, in Ontario the chestnut and walnut occur as far north as Oakville, while the sycamore and sassafras reach Toronto in the Don and Humber valleys. A number of austral insects also find their northern limit in this vicinity.

On the other hand, boreal conditions are met with in the Transition Zone, in bogs, particularly sphagnum bogs, these constituting the boreal islands that have already been alluded to. In such bogs the vegetation and the insect life, too, are decidedly more northern than that of the surrounding country. The trees are largely tamarack, black spruce and willows, and the bog-plant society in general consists of the same species as occur in the peat-bogs of the Canadian and Hudsonian Zones. Similarly, bogs in the Upper Austral Zone are largely occupied by species of the Transition and Boreal Zones.

The arid or western division of the Transition Zone is fairly extensive in

Canada, including, according to our map, practically the whole of the prairie country as well as the semi-arid district in the southern part of the interior of British Columbia. Part of the humid region on the Pacific Slope is also included in this zone, though the fauna and flora of this region are extremely different from that of the prairies.

To the present writer it seems that the northern boundary of this zone is placed too far north in the Prairie Provinces as compared with the corresponding boundary in Ontario. This seems to be true at least in regard to the Odonata and Orthoptera, as I have received from within the limits of the Transition Zone in Manitoba and Saskatchewan some very decidedly boreal species which do not appear to occur in Ontario south of the Canadian Zone. It may be noted in this connection that the mean July isotherm of 65 deg. F. corresponds fairly closely to the southern boundary of the Boreal Region in the Eastern Provinces, but does not run so far north in Manitoba and Saskatchewan.

In the arid district of the Transition Zone, there are certainly many species of both plants and animals which are common to the Transition Zone of the East, but these are mostly boreal species of transcontinental distribution, and there is but little in the austral element of the two regions to warrant their inclusion in the same zone. The physical conditions of the western prairies and eastern forests are, however, so unlike that it is somewhat difficult to compare them. In the Orthoptera, most of the austral species are of south-western origin, the Carolinian element being decidedly lacking.

Before closing this brief survey of the faunal zones of Canada, we must not fail to make mention of the conditions met with in British Columbia. The composition of its fauna, however, is too little known to warrant any positive statements concerning it. Though most of it is included in Merriam's Boreal Region and in the great transcontinental forest belt, most of the trees belong to different species from those of the eastern part of this region, and similar statements could probably be made of any group of plants or animals inhabiting it. The fauna and flora of this region seem to have entered it primarily from two directions, viz., from the south-west and from Asia. The bulk of the species seem to have entered from the Rocky Mountains and Pacific Coast south of the Canadian border, and many of these have decided Californian and Mexican affinities. On the other hand, there are many species of distinctly Asiatic type, which do not occur on the eastern side of the continent. The presence of such forms, particularly in the Alaskan region, is important evidence of the existence of a land-bridge across Bering Sea in early glacial times. To a limited extent this western region has also been invaded by north-eastern forms.

Finally, let me call your attention to the close relationship that exists between the boundaries of the faunal zones of our map, as far as Canada is concerned, and the mean isothermal lines for July. According to Merriam, the southward distribution of northern species is determined by the mean temperature of the hottest time of the year, which should not be very different from the mean temperature of July. Thus the present map is essentially a map of temperature zones, but not one of primary zoogeographical provinces.

In conclusion, I should like to impress upon all collectors the value of keeping in mind the standpoint of geographical distribution, while on their collecting trips. Not only will the data for a proper understanding of the problems of zoogeography be more thoroughly accumulated, but the collector will experience new delights in the course of his wanderings, and will feel more keenly than ever the rare pleasure of collecting in a new locality.

REVIEW OF ENTOMOLOGY RELATING TO CANADA IN 1912.

C. Gordon Hewitt, D.Sc., Dominion Entomologist, Ottawa.

It has been my custom in addressing the Society on previous occasions to briefly relate the more important developments which have taken place in connection with the work of the Division of Entomology of the Experimental Farms Branch of the Dominion Department of Agriculture, located at the Central Experimental Farm, Ottawa.

This year we are fortunate in having with us at our meetings a number of the field officers of the Division of Entomology who have been carrying on investigations in different localities, and they will be able personally to communicate to you the results of their investigations. I wish to consider broadly, for a short time, certain matters affecting Canadian entomology, which have arisen during the past year. I shall, therefore, divide my address into three parts, and I shall consider how our problems have been affected by International, Imperial and Canadian developments.

As representative of the Canadian Government and also as representative, together with Mr. Henry H. Lyman, of this Society, I had the privilege of attending the International Congress of Entomology which was held at Oxford in August. An account of this meeting has been published by me in the current (November) issue of "*The Canadian Entomologist,*" and therefore I need not take up the time of the meeting with a description of the various interesting and important aspects of this international meeting.

I would like, however, to refer to two matters which came up for discussion at the Congress, as I think they will be of special interest to the members of the Society. As might be expected, the question of nomenclature was prominent in discussion, having been introduced at the instigation of the Entomological Society of London, and after an interesting and useful discussion it was finally decided to appoint international and national committees to deal with this very vexed question of nomenclature. Each of these national committees would refer its important inquiries to the International Committee for its decision, and the International Committee would consult with the International Committee on Zoological Nomenclature, which is the final committee of appeal on all questions of zoological nomenclature. It was felt, and rightly so, that entomology was not adequately represented on the International Committee of Zoological Nomenclature in view of the fact that insects form by far the greater part of the terrestrial fauna, this lack of representation is admittedly unfair and has been responsible to some extent for the formation of a committee of the International Congress of Entomology to deal with these questions of nomenclature.

To my mind one of the most important considerations is the question as to what would happen in the event of disagreement between our International Committee on Entomology and the International Committee on Zoological Nomenclature, and I was very pleased to receive publicly from Dr. Karl Jordan, the Secretary of the Congress, the assurance that in cases of such disagreement the findings of the International Committee on Nomenclature would prevail. I believe that the formation of these national committees and the International Committee will be productive of much good in deciding disputed questions.

Among the many interesting, suggestive and valuable papers dealing with the problems of economic entomology none was productive, to my mind, of so inter-

esting a discussion as a paper read by Mr. Rogers of the British Board of Agriculture, on the question of legislation and the control of insect pests. As a result of this discussion a resolution was moved in support of the proposed formation by the International Institute of Agriculture at Rome, of an international commission to deal with the broad question of the prevention and spread of insect pests, and this resolution was unanimously adopted by the Congress.

This brings me to the second part of my address and to a consideration of the Imperial aspect of entomology. During the past year the Colonial Office and the various self-governing Dominions and colonies have had under consideration a scheme for the formation of an Imperial Entomological Bureau. A scheme was submitted last year, and during my visit to England at the beginning of the year I consulted with the Entomological Research Committee of the Colonial Office in regard to this scheme, which appeared to us to be too restricted in its character. The idea was to assist the self-governing colonies and dominions in preventing the spread of insects within the empire, by collecting and distributing information from all parts of the empire with regard to the prevalence and distribution of insect pests.

In case of Canada, however, we obtain the greater part of our natural products from non-British countries, and consequently we have to keep ourselves informed of the prevalent insect pests in those countries. We, therefore, felt that if the collecting of this information, relative to injurious insects, was confined to the countries within the British Empire we should derive very little benefit from it.

To work out a scheme satisfactory to all the Governments concerned, therefore, the Colonial Secretary took advantage of the International Congress of Entomology and called a conference at the Colonial Office of the entomologists and representatives of the various self-governing dominions and colonies. This conference took place in August and it is a matter of very great gratification to us to find that our proposal for a more extensive scheme met with the unanimous approval of the representatives at this conference, and the scheme which was worked out at the conference has now been submitted to the various governments for their approval and adoption. It is proposed to form in connection with the Colonial Office an Imperial Entomological Bureau which would be maintained by contributions from the dominions and colonies, and also from the Colonial Office. Its functions are mainly three: First, it will collect, not only from the colonies, but also from non-British countries, information regarding the occurrence and distribution of injurious insects. This information will be filed for purposes of reference, so that any colony which may be desirous of importing or may be actually importing vegetation or other natural products from another country may inform itself, by applying to the Bureau, what pests it is likely to import on such commercial products, and may thus determine whether in its own interests it is advisable to protect itself by legislation, or by other means against the introduction of dangerous insect pests. The great benefit which will accrue from this function of the Bureau will be obvious to you all, and it will be an especial benefit to those colonies whose entomological services may not be so well organized as others. In addition to the collection and distribution of this information the Bureau will also undertake the identification of insect pests for the various colonial entomologists, and with the co-operation of, and the proximity to, the British Museum of Natural History with its immense and valuable collections, the Bureau will be able to render valuable services to the colonies in this regard. Not

the least important of the Bureau's activities will be the publishing of a monthly journal for distribution to the colonies, which journal will contain summarized abstracts of current literature relating to the control and eradication of insect pests. With the increase of entomological literature and with the decrease of opportunity which entomologists have with their increasing duties to keep themselves acquainted with all that is being published on economic entomology, the value of a journal of this nature cannot be overestimated, and it will be especially appreciated by and of great value to those entomologists working in countries where they have not access to scientific libraries and where scientific literature is conspicuous by its absence. To them, most of all, will such a journal be useful. I look forward very much to this Imperial Bureau becoming a powerful factor in the general campaign against insect pests and their spread.

Turning from Imperial matters to Canada, I will briefly refer to the various developments in entomology in this country during the past year. One of the most important extensions of the work of the Division of Entomology has been the establishment of field laboratories, to the proposed establishment of which I referred in my address twelve months ago. These stations are now an accomplished fact and by means of their establishment we have been able to carry on important investigations in a wider field. During the past year field work has been carried on in Nova Scotia, New Brunswick, Quebec, Ontario (two stations) and British Columbia, and most of our field officers carrying on the work at these stations will give brief accounts of their respective investigations at this meeting. I need not, therefore, refer to them more fully.

Two other branches of our work have been extended, and assistant entomologists have been appointed to devote their special attentions to these branches. Mr. J. M. Swaine was appointed last December to take charge of the work on forest insects, and during the past summer he has made very marked progress in this work which has been so long neglected in Canada, but which now needs all the attention we can give it if the conservation of our forest is to be studied in its necessarily broad manner. Mr. Swaine will give an account of his season's work and his visits to Manitoba and other parts of eastern Canada. I am also pleased to announce that by the appointment of Mr. F. W. L. Sladen we shall be able to give to apiculture the attention which it deserves, and we are proposing to carry on experimental work in queen breeding and other branches which are essential for the prosperity and extension of bee-keeping in this country. A long, intimate and practical experience in bee-keeping in England has made Mr. Sladen unusually well qualified for this work, and we are fortunate in having so distinguished a Fellow of the Entomological Society of London with us permanently. Mr. Sladen, in addition to his studies of the honey bees, has made a life-long study of the Bombi, and he will give us to-night an account of some of his work.

The inspection work under the Destructive Insect and Pest Act is now well organized, and the amount of work it entails upon the Division will be realized by the fact that the last importation season about 4,000,000 plants were inspected. One instance alone which I am mentioning will indicate the value of this inspection work. Mr. R. C. Treherne, our officer in charge of our work at Vancouver, discovered in a shipment of trees from Japan a *Thuja* on which no less than eight egg masses of the Gipsy Moth were found, and by the time these reached Ottawa, hundreds of the larvae had emerged. Such a discovery as this needs no comment. The field work in Nova Scotia and New Brunswick which consists in scouting the

infested and likely-to-be-infested areas, was completed in May. We found that the area in New Brunswick had increased enormously, although the infestation was very lightly distributed. In Nova Scotia the area and infestation were about the same.

During the past year also we have continued and extended the work of importing parasitic enemies of our worst insect pests. For the purpose of importing the parasites of the Larch Sawfly, the chief of which is the Ichneumon, *Mesoleius tenthredinis,* I visited the English Lake District in January and discovered a locality where I found the cocoons of the Larch Sawfly well parasitized. Arrangements were made for the collection of the parasitized cocoons and these were shipped to us in the spring. Mr. Swaine then took them with him to the Riding Mountain Forest Reserve in Manitoba where we are attempting to establish them. Our reason for establishing them on this western point is that this point appears to be the present western limit of the spread of the Sawfly. I should say in passing that I previously referred to the chief Ichneumon parasite of the Larch Sawfly as *Mesoleius aulicus,* but it has since been found that the species which I studied was a new species to which the name *Mesoleius tenthredinis* has been given.

Turning from our work in the Division of Entomology to provincial matters, it is a matter of great gratification to us all to be able to record the development of entomology in the Provincial Departments of Agriculture as evidenced by the appointment of entomologists in three provinces. In British Columbia, Mr. W. H. Brittain has been appointed as Plant Pathologist and Entomologist, and we hope that he will be able to find time to devote to insect pests as well as plant diseases, although both offer enormous fields for investigation in British Columbia. In Nova Scotia Dr. Robert Matheson, late of Cornell University, has been appointed Provincial Entomologist, and we are delighted to have succeeded by this appointment in bringing back so hard working an entomologist to his native country. Mr. Caesar has been appointed Provincial Entomologist for Ontario, although I understand that the appointment has not yet been officially confirmed. His colleagues and friends will be glad that his services for Ontario have thus been officially recognized. With these provincial appointments and the prospect of co-operation between the Division of Entomology at Ottawa and the Provinces, I look forward to a rapid and useful extension of our work in the near future. We have an enormous field to cover and we shall still have to spread ourselves out in order to touch even the borderland of what lies before us.

Before concluding my address, I shall like on behalf of the Department here to extend to you all a most cordial welcome. It is a source of unusual pleasure for us to see gathered together representatives from so many provinces. We have representatives from Nova Scotia, New Brunswick, Quebec and Ontario, and papers will be read from members in Manitoba and British Columbia who are unable to be with us. The coming together in this way of entomologists from so wide an area cannot but result in discussion which will be of the greatest value to all of us in our work. I am sure that we shall all go away from these meetings feeling that our deliberations have enabled us to advance in our work, so increasingly important in helping on the development and increasing the productivity of this great country.

THE TEACHING OF ENTOMOLOGY IN OUR AGRICULTURAL COLLEGES.

Prof. Wm. Lochhead, Macdonald College, Que.

In the discussion of this subject two points must be clearly kept in view: first, the curriculum of the colleges, and second, the object of the courses in Entomology.

With regard to the first point, it should be borne in mind that the curriculum of our Canadian Agricultural Colleges differs from that of Agricultural Colleges in the various States of the republic to the south of us, in that our colleges for the first two years arrange their courses in such a way that the students are able to apply directly the information received on their home farms on their return. Accordingly, considerable attention is given during the first two years to the study of live stock, agronomy, horticulture, and dairying, where methods and practices and the general principles underlying them are emphasized. But in order to deal effectively with the general principles, some knowledge of chemistry, physics and biology is necessary; hence those sciences are studied with the object of bearing directly on agriculture.

The presentation of the subject matter in the sciences must necessarily be different in a two-year course from that in a consecutive four-year course, which prevails in the Agricultural Colleges in the States. Our Canadian colleges may justly pride themselves upon the excellent adjustment of their curriculum to the needs of their students. Results, I believe, have justified the wisdom of the establishment of the Diploma Course and the Degree Course, up to the present time at any rate. Future developments may demand a continuous four-year course for the entrance for those who desire a degree in preparation for teaching, investigation, etc.; but I believe the Diploma Course will always be a necessity.

In view of the fact that our curriculum of the first two years is designed especially for the Diploma Course, it is evident that entomology must be presented in such a way that primarily it will help the young farmer to protect his crops. At the same time we should not forget that entomology is a cultural subject, and should be a means of training the young men to observe carefully, to experiment, and draw conclusions. It should also give them an added interest in the great world of nature about them, and enable them to get a glimpse into the wonderful web of life with all its marvellous inter-linkages. This phase of the subject is, in my opinion, one of the most important from the standpoint of citizenship. From a study of the insect world it is an easy matter to direct their attention to inter-linkages in the social world.

Another factor must not be lost sight of, and that is the short time available for the study of entomology. We all know how crowded the curriculum is on account of the number of valuable courses that must be given.

Now the difficult problem for the instructor is to determine the scope of his course—what he should include and what he should leave out.

In my judgment the main attention should be paid to the chief insects that injure the staple crops, by a concise study of their appearance, life-history, and methods of control. These studies, however, should be preceded by studies on the structure of insects, both external and internal, and on the classification into orders. Some attention should also be given to beneficial insects so that they may be recognized.

There is a difference of opinion as to the best method to pursue in discussing the chief injurious insects in an elementary class. For some years I discussed them according to the orders to which they belong, after the manner of J. B. Smith's "Economic Entomology," and I obtained fairly satisfactory results. By this method the relationships of the forms discussed are kept constantly before the minds of the students—a matter of some importance, I admit, for students who may wish to pursue their studies further in the third and fourth years.

The other method is to discuss the insects according to the host after the manner of Sanderson's "Insect Pests of Farm, Garden and Orchard," and Saunders' "Injurious Insects of the Orchard," and Weed's "Insects and Insecticides." The advantage of this method is that the student's attention is constantly directed to the crops that are injured.

Personally I am in favor of the latter method for the class of students we have to deal with.

Third Year: In the Third Year, however, the students are preparing themselves to become investigators, teachers, etc.; hence more attention should be given to entomology as a science. Some familiarity with the families and chief genera is demanded, and this can be best acquired by practical work in the laboratory. Comstock's Manual is perhaps the best book to use in this connection, although Sanderson and Jackson's "Elementary Entomology" with its many keys is also an admirable work. Its lower price will tend to make it more popular with students.

My plan for the Third Year class is to devote the fall term to a more detailed study of the anatomy of some typical insects, and to a study of the chief families and common genera, and the winter term to a more detailed study of the economic forms. Sanderson's "Insect Pests of the Farm, Garden and Orchard" makes an excellent text-book for the winter course, but it is unfortunate that the price is so high. According to this plan both of Sanderson's works are necessary for the year's work, but the cost of two such books is to some extent prohibitive.

For the same reason, the introduction of Sanderson's larger book for the Second Year class meets with disapproval on the part of most students.

Fourth Year: The entomology of the Fourth Year is of necessity taken by students who are specializing. Special problems are assigned for study and discussion, and methods of work and a knowledge of the literature are emphasized.

A New Book Needed: From what I have already said it may be inferred that there is a pressing need for a textbook or handbook of entomology that will serve the needs of the students during the Second and Third Years, and that will at the same time keep the cost within moderate bounds.

I venture here to suggest a plan of contents of such a book, which would be a handbook rather than a textbook. Part I would deal with anatomy, metamorphosis, and reproduction, and would contain laboratory exercises. Part II would contain host-keys for the identification of the injurious insects according to the manner of injury done to the root, stem, leaf or fruit.

Part III would contain concise descriptions of these insects arranged according to order and family; and simple keys might be inserted to enable the student to identify them.

Part IV would deal with methods of control. Part V with general entomology; and Part VI with collecting and preserving insects. By a system of cross-references full information regarding the life-history and methods of control of each insect could be readily obtained.

This plan would, in my opinion, make the handbook a most useful and valuable work and guide. Moreover, much needless repetition would be avoided, and the instructor could without much trouble select the portions best adapted to his classes in both the Second and Third Years.

THE RISE IN PUBLIC ESTIMATION OF THE SCIENCE OF ENTOMOLOGY.

Rev. Thomas W. Fyles, D.C.L., Ottawa.

> "Listen not to those who tell thee
> That ours is a worthless study,
> Worthless from the very smallness
> Of the creatures that we study;
> Solomon, of men the wisest,
> Taught a very different lesson."
>
> —*The Insect Hunters, Ed. Newman.*

How great a change in popular opinion has taken place within the memory of the older men among us in regard to the lesser objects of Creation, and those who give attention to them. Men in former days were disposed to look upon entomologists with contemptuous amusement. The people of Compton were wont to speak of Gosse as "that crazy Englishman who goes about picking up bugs."

The common people, both in England and Canada, were profoundly ignorant as to the nature, habits and life-histories of the smaller living things; and where Ignorance prevails, Superstition finds admission.

Those were the days when the dragon-fly was called the Devil's Darning-Needle; and *Ocypus olens*, the Devil's Coach-horse. The Death's Head Moth (*Acherontia atropos*) was regarded as the herald of the king of terrors, and the red spider as the harbinger of fortune. That prolific writer, Baring Gould, founded one of his best stories upon the latter misconception.

The most erroneous speculations in regard to minute living things were indulged. I call to mind the look of complaisant amusement, befitting one who possessed superior knowledge, with which a man once regarded me, when I told him that the hair snake (*Gordius varius*) came from an egg, one of a chain of eggs laid by the mother Gordius. He had been one of a party led by a guide into the wilderness in search of moose. After tramping some miles, the hunters came to a stream. The guide, looking into the water, exclaimed, "Ah, there are moose not far away! Here are moose-hairs turned into snakes." The *guide* said this—an *experienced* guide; and my friend believed it. Confidence in the guide is necessary for the belief in modern miracles.

But while some country people were credulous, others were of a sceptical turn of mind.

A country clergyman, desirous of improving his people, invited a well-known microscopist from the city to give a lecture in his parish. The gentleman came, and took for his subject *"The Amoeba."* This creature—which belongs to the *Protozoa*—appears as a mere limbless speck of sarcode. When an impulse to move

comes upon it, it extrudes a leg—if you choose to call it such—and then draws itself into the leg; and so changes its place. When it comes in contact with a particle of food, it extemporizes a mouth and puts itself outside the substance. If this proves suitable it assimilates it; if not, it ejects it at the nearest point.

The lecturer described the creature, and told of its ways, and made a witty and interesting address; and then the people were dismissed. On their way home, the village blacksmith turned to one or two of his cronies, and said sarcastically, "Was it worth that man's while to come out all this way, and try to stuff us like that?"

A perception of the importance of entomological pursuits was gradually brought about in the public mind through the occurrence of a series of insect plagues—the ravages of the Hessian Fly, of the Midge, the Locust, the Potato-beetle, the Cabbage-worm, the Phylloxera, the Larch Sawfly, etc. The trouble over these induced men to read and spread the information published by Entomologists, as to the nature of the pests, and the ways of combating them. And the impression was made and deepened that an Entomologist was not one who merely engaged in the childish sport of chasing butterflies, or indulged his miserly propensities by storing away his captures.

One of the first publications to help the Canadian farmers to a right appreciation of Entomological pursuits was Hind's "Essay on the Insects and Diseases Injurious to the Wheat Crops." It was awarded a prize by the Bureau of Agriculture and Statistics, Toronto, in 1857, and was distributed amongst the farmers of the country. The copy I have was sent to George Boright, of East Farnham, by James Moir Ferris, M.P. for Brome. When Mr. Boright died, his widow gave the book to me.

The essay opens with—

A Treatment and Classification of Insects.

It treats of—

The Hessian Fly.
The Wheat Midge.
The Wheat Stem-fly, and other Depredators.

It describes—

Rust—Smut—Pepper Bread—Ergot. And lastly it tells of Insect Enemies of stored grain.

Hind derived his information largely from American sources—from Fitch particularly.

A delightful book that found its way to Canada was Gosse's *Canadian Naturalist*, published by Van Voorst in 1841. In it the author tells of "Walks and Talks" of a father and son, in the neighbourhood of Compton, Province of Quebec. Gosse was master of the school at Compton when he wrote the book. I purchased a copy of it in Hill's book store, Montreal, in 1862.

The peripatetic mode of teaching supposed to be carried on by the father of the *Canadian Naturalist* was no new thing in the world. It was the mode pursued by the noted educator Pestalozzi, and long before him by the philosopher Aristotle; and above all it was the method of Him who led his disciples over the hills of Judea, and taught them divine lessons from common things.

Gosse may, or may not, have seen a work entitled "Spectacle of Nature, or Nature Displayed," translated from the French by Samuel Humphreys, and dedicated to "His Royal Highness the Duke of Cumberland." In the dedication of this

work the translator says: "The amiable qualities with which nature has enriched Your Royal Highness, have been so happily cultivated by the best of educations, that I am persuaded the wonderful scenes of Providence, so elegantly displayed in this treatise, will not be considered by Your Royal Highness as an unpleasing entertainment," etc. If I mistake not, this Duke of Cumberland was the same who, seven years afterwards, on Drummossie Moor, slaughtered the followers of Prince Charles Edward, and gained the title of Butcher Cumberland.

My copy of the "Spectacle of Nature" is one of the fourth edition, printed in 1739. It is profusely illustrated by Madam Cochin. The insects figured are easily recognized. The dialogues in this work are supposed to be carried on by the Count and Countess de Jonval, the Prior de Jonval, and the Chevalier du Breuil (the youth under instruction). I obtained the book in a second-hand book-store in Montreal.

No doubt incoming naturalists brought in works of the masters in Entomology. I have seen in Canada the productions of Swammerdam, Latreille, Kirby, Drury, Stainton, Thomas Say—the father of American Entomology—and others, but these would be read by few. I have also found in second-hand book-stores, popular works likely to interest the young, such as, Knight's "Insect Miscellanies," London, 1831, and the "History of Insects," Religious Tract Society, 1839. *Seed had been scattered.*

A grand movement for the advancement of practical entomology was made when the Rev. C. J. S. Bethune, M.A., of Cobourg, and W. Saunders, Esq., of London, issued a circular, calling upon those interested in Entomology to meet in Toronto, on the 16th of April, 1863. The following are the names of those who responded to the call. Prof. W. Hincks, F.L.S., Prof. H. Croft, D.C.L., Beverly R. Morris, M.D.,* J. H. Sangster, A.M., and J. Hibbert, of Toronto; Thomas Cowdry, M.D., and H. Cowdry, York Mills; Rev. C. J. S. Bethune, M.A., of Cobourg; W. Saunders, London.

The Society formed at this meeting received encouragement and support from the Ontario Government, and grew rapidly. It was incorporated in May, 1871, and its first general meeting was held on September 27th in the same year. The officers elected on that occasion were:—

President: Rev. C. J. S. Bethune, M.A., Trinity College School, Port Hope.
Vice-President: W. Saunders Esq., London, Ont.
Secretary-Treasurer: E. Baynes Reed, Esq., London, Ont.
Council: Prof. H. Croft, University College, Toronto; Prof. J. Macoun, Albert College, Belleville; R. V. Rogers, Esq., Kingston; J. M. Denton, Esq., London; J. Petit, Esq., Grimsby.
Auditors: J. H. Griffith, Esq., and C. Chapman, Esq., London.

Of those whose names are given above three men are entitled to our deepest respect and gratitude, because of the support they have given to our Society, and because of their eminent services to the community at large.

Dr. C. J. S. Bethune, Professor of Entomology in Ontario Agricultural College, was for many years the Head Master of one of our great public schools; yet, notwithstanding the many duties that devolved upon him, he remained all the time, and has continued to this day, a firm supporter of the Entomological Society of Ontario. We all deeply regret that a severe affection of the eyes keeps

* Dr. Beverly R. Morris returned to England shortly afterwards. He was a brother of the Rev. F. O. Morris, M.A., Member of the Ashmolean Society, etc., author of a "History of British Birds," "A Natural History of British Moths," and "A History of British Butterflies."

him from us to-day; and we devoutly wish him speedy relief and a complete cure.

Dr. William Saunders was President of the Entomological Society from 1875 to 1886, and Editor of the *Canadian Entomologist* from 1874 to 1886. His appointment as Director of the Experimental Farms of the Dominion—a position for which he was admirably fitted—was the cause of his retirement from office in the Society.

We have as a token of Dr. Saunders' entomological ability, his valuable work on "Insects Injurious to Fruits." For this, and in recognition of his many scientific attainments, the Duke of Mantua and Montserrat presented him with a handsome gold medal.

Professor John Macoun, F.R.S.C., F.L.S., Naturalist for the Geological Survey, is noted throughout this continent for his ornithological and botanical works.

Such men as these could not but raise in public estimation any cause to which they gave their names and support.

An important Government appointment, following upon that of Dr. Saunders, was that of Dr. James Fletcher as Botanist and Entomologist for the Experimental Farms. Dr. Fletcher's extensive knowledge, his genial manners, his ready speech and his goodly presence, made him a very welcome visitor at meetings of Agricultural, Horticultural and other societies, and he did much, throughout the wide Dominion, to bring the study of Entomology favourably before the people.

Dr. Fletcher was one of those who, in 1879, established the Ottawa Field Naturalists' Club, a very important association, the leaders of which conduct its members into the fields and woods, and point out to them the wonders of Creation, and the lessons that may be learned from them. Mr. Arthur Gibson, so long and so well known as an able Entomologist, is the Editor of its organ *The Ottawa Naturalist.* The Club numbers over 300 members.

Another association worthy of our consideration is that which has its headquarters in Macdonald College at Ste. Anne de Bellevue—an institution that was raised and endowed, at a cost of $5.000,000, by the munificent patron of learning, Sir William Christopher Macdonald. The Association I speak of is the "Quebec Society for the Protection of Plants." With it some of our best known Entomologists are connected—notably Professors Lochhead and Swaine. The Society has issued four Annual Reports, and also a capital list of the Lepidoptera of Quebec Province, by Mr. A. F. Winn. These have been printed by order of the Quebec Legislature. The Society has a membership of 60 persons.

Now consider for a moment the numbers I have adduced:—

After notice of meeting had been issued—9 persons only—one of them a boy, assembled in Toronto to form the Entomological Society of Ontario; the Ottawa Field Naturalists number now over 300; The Preservation of Plants Society, 60. Do not these figures betoken an increased interest in Nature Studies? Our Ontario Entomological Society numbers at the present time 141 members.

In its early years the Entomological Society was disposed to itinerate. Its annual meetings from 1871 to 1877 were held successively in Kingston, Hamilton, London, Toronto, Ottawa and again in Hamilton; but for 28 years after, with but seven interruptions, they were held in London. Members good and true resided in that city and its vicinity; and the Geological, Botanical, Ornithological, and Microscopical Sections of the Society there did excellent work. There, too, Mr. J. Alston Moffat, most patient and obliging of curators, devoted himself to the duties of his office. In the Annual Report for 1897 there is a picture of him and of the library he loved so well.

In 1907, by arrangement with the authorities of the Ontario Agricultural College, the headquarters of the Society were taken up in that institution. The most important gain in the removal was that the influence of the Society was brought to bear upon the farm-students and teachers-in-training in the College. A like advantage is enjoyed by the Society for the Protection of Plants, at Ste. Anne's, which has both English-speaking and French-Canadian members.

When I moved to South Quebec in 1883, the Abbé Provancher was living at Cap Rouge, and I had some correspondence with him respecting a saw-fly which proved to be a new species. Provancher may be regarded as the father of French-Canadian Entomology. He originated, and edited for twenty years, that useful magazine, *Le Naturaliste Canadien,* which is still ably carried on by the Rev. V. Huard, Director of the Quebec Provincial Museums, etc.

Provancher also published three volumes of "Faune Entomologique du Canada," the excellence of which is shown by the demand for them.

Now, there are good men in many of the French-Canadian parishes and institutions giving attention to Entomology—notably the Rev. Abbé Roy, of Levis, and the Rev. Abbé Begin, of Sherbrooke.

Of the great and far-reaching influence that American Entomology has had in Canada a ready token will be found in our reports and other literary productions. I speak of the elegant little monogram formed of the letters C.V.R., standing for Charles Valentine Riley.

You will find this monogram in the cut of *Agrotis ypsilon* in Winn's list just published: you will find it in that of the Clover Leaf Borer, in the last report of the Quebec Society for the Protection of Plants; you will find it in that of the Diamond-back Moth, in the last report of our own Society. It appears also in Saunders' "Insects Injurious to Fruits," in the cut of the Codling Moth on page 127, and again in the cut of the Rocky Mountain Locust, on page 158. All these, and many other illustrations we meet with, have been printed from electrotypes from Riley's drawings.

Charles Valentine Riley, the marvellous boy, who, a poor English immigrant, went to work on an Illinois farm, and then, as time passed on, by his untiring perseverance, his powers of observation, his careful studies, his love of Nature, his wonderful skill as a draughtsman, raised himself step by step, till he became the chief of the Bureau of Entomology in the Department of Agriculture at Washington, and was honoured with the degrees of M.A. and Ph.D.—how much he did in the cause of Entomology, and how greatly his labours have benefited us here!

Alas, Dr. Riley was cut off, "in the midst of his days," by an accident—as some one has said, "he rode to his death on a bicycle." Speaking to me on this sad event, Dr. Bethune said: "Among Entomologists, Riley was *facile princeps.*" The *Entomologist's Monthly Magazine* of London, England, had previously spoken of Riley as "the foremost economic entomologist of the day." Riley was worthy of much praise. But this can be truly said: Never was better work done in the Bureau of Entomology at Washington than is done at this day, by Dr. L. O. Howard and his staff of zealous assistants. The pamphlets under the heads of Technical Series, Circulars, and Farmers' Bulletins are excellent and are scattered broadcast. They must have a wonderful effect upon the community at large.

A glance through our own publications will convince one that we are under great obligations to American scientists.

What pleasure and profit we have derived from addresses from L. O. Howard, F. M. Webster, John B. Smith, Ephraim Porter Felt!

Science knows no political boundaries; and between Canada and the United States there has always been, and I trust always will be, free and unchecked Entomological reciprocity.

Speaking of intercourse with the Americans, let me bring in an episode:—

Once upon a time when I was Rector of Nelsonville (Cowansville and Sweetsburgh), I received a request from Sheldon, Vermont, that I would give a lecture upon "Our Insect Friends and Insect Foes." I complied, and, the winter roads being good, I took my horse and sleigh, and one of my boys, and drove to Sheldon. It was a long drive; but we reached our destination in good time for the lecture. We had a full house. At the close of the proceedings we found that it was snowing. It snowed all night, and all the next day (Friday). We were in for what is called in those parts a three days' storm. At night I said to the gentleman with whom I was staying: "I must, if any means be possible, get home to-morrow, for my Sunday duties." We planned that I should leave my boy and team with him, till the roads were broken out, that I should take the train from Sheldon to St. Albans, and catch the Montreal Express. This would carry me to St. Johns, where I could take the South Eastern to Cowansville. Accordingly next morning I went to the station. The storm was at its height. A man came in, and as he shook the snow from his fur coat, exclaimed, "What do you call this—a Canada thaw?"

I followed the course we had planned—reached St. Albans—caught the express —I left it at St. Johns—took the South Eastern—but, alack! at West Farnham the train came to a dead stop—the line was completely blocked.

I took refuge with my friend, the Rev. T. W. Mussen, and, next morning, as there was no movement on the line, assisted him in the services of his church. As we were leaving the building word was brought to us that men with an engine and snow-plough were about to open the track as far as Cowansville. I entered the snow-plough. In it were half-a-dozen navvies with picks and shovels. Everything was icy. We started—*Thud—grind—bump—retire—charge again!* And so, for five hours. We reached Cowansville at half past six. I was cold, tired, and bruised, but I found the sexton, bade him light up the church and ring the bell; and the Lord's Day did not pass without public worship in my parish.

I have given, by request, twenty-five such lectures as I gave at Sheldon, in halls and school-houses, in different parts of the country; and the desire for information upon entomological subjects—even from so poor an exponent of them as myself—betokens, I think, a considerable advance in public estimation of the Science of Entomology.

To go back a few years: Montreal at the time I lived in it was but a small city. It had I think 66,000 inhabitants. I could find in it only one entomologist, Mr. Barnston, who lived on City Councillor Street. Mr. George J. Bowles and Mr. William Couper then lived in Quebec.

Ten years after I left, five gentlemen met by chance on Mount Royal, and decided to form a Branch of the Entomological Society of Ontario. They and two others met on the 16th of October, 1873, and elected officers:—

President: William Couper.
Vice-President: H. Kolmar.
Secretary-Treasurer: F. B. Caulfield.
Council: G. J. Bowles, P. Kuetzing, and C. W. Pearson.
Curator: William Hibbins.

In the Notes of the Meeting, this sentence, which bears upon my subject, appears: "Your Council strongly impress on the members to use their influence in promoting the knowledge of the importance of the study of entomology, more especially with agriculturists and horticulturists, in order to enable them to check the ravages of the numerous insects injurious to vegetation."

In the notes of the fourth Annual Meeting of the Branch, the name of Mr. H. H. Lyman appears as one of the Council. At the eighth Annual Meeting he was elected President, and again on the fifteenth.

The name of Mr. A. F. Winn appears in the sixteenth report of the Branch as one of the Council, and in the seventeenth as Secretary-Treasurer.

Both Mr. Lyman and Mr. Winn have been zealous and helpful supporters of the Branch to this day; and they and their fellow-workers appear to have faithfully acted upon the suggestion of their Council above quoted.

At the close of his annual address as President of the Entomological Society of Ontario, Dr. Wm. Saunders, in 1883, made use of the following words:—

"Who will press to the front, and fill the vacant places in our ranks?" The question has an air of sadness like that in the old song:—

"Who will fill our vacant places?
Who will sing our songs to-night?"

"One by one," continued Mr. Saunders, "our busy workers pass away."

Yes, William Couper, (I will speak only of those whom I personally knew.) G. J. Bowles, F. B. Caulfield, W. D. Shaw, J. M. Denton, Very Rev. Dean Innis, Rev. Vincent Clementi, J. Alston Moffat, Captain Gamble Geddes, J. A. Balkwill, Prof. J. H. Panton, Dr. W. Brodie, and Dr. James Fletcher have all passed the "Great Divide," but they have left pleasant memories behind them.

"But," concluded Dr. Saunders, "our favourite branch of natural science still lives, and will continue to assert its increasing importance, and to confer its benefits on all succeeding generations."

While our Society continues to bring forward, or attract to itself, such able men as are now filling its offices, and carrying on its affairs, its influence with the public will not abate. And now with an expression of a hearty wish that these men may have wider and wider opportunities for making known the wonders of the Insect World, the benefits we derive from our Insect Friends, and the best means of resisting the attacks of our Insect adversaries, I bring this, my seventieth contribution to the Reports of the Society, to a close.

THE CHINCH BUG IN ONTARIO.

H. F. Hudson, Division of Entomology, Ottawa.

The present brief paper embodies the result of an investigation into the Chinch Bug situation in Western Ontario which was carried on during the past summer, and for general interest I have included the most recent methods which have been adopted in Illinois with such success to combat this well-known pest. Probably no single insect pest has caused such fatal results to the staple grains of America than has this one. Investigation work was begun in the middle of

May, but a previous brief visit to the infested area was made by Mr. G. E. Sanders of this office in the early part of the year, when the bugs were in their winter quarters, hibernating under leaves in woodlots and under rubbish of all descriptions.

At the time of my visit, in the latter part of May, a large proportion of the bugs were in coitu, but I was then informed that they were noticed pairing at least a week previous to this. A few pairs in copula were taken and put in pairs on oat plants growing under glass chimneys to ascertain the earliest date of oviposition, the period of egg laying and the number of eggs usually laid by a single female. The first eggs were deposited May 28th, and these hatched June 18th, the average egg production for the female being 95, the period of oviposition being 18-19 days; but under field conditions the period of oviposition for the whole brood covers a period of six weeks. The weather throughout was cool and moist, which no doubt retarded the hatching of the eggs.

Fig. 14.—Chinch Bug.

Life History. The eggs are about .03 in. in length, elongate-oval in shape, rather narrowly rounded at one end, and slightly squared at the other, from the end of which may be seen four small rounded tubercles. The newly deposited egg is whitish and translucent, but soon changes to an amber shade, and finally, as the insect develops within, becomes definitely red. The Chinch Bug is dimorphic, there being both a short and a long-winged form, and both forms are present, the greater proportion, however, being of the long-winged type. Except after the final moult, the immature stages are identical, and, so far as I know, they have never been distinguished. The newly hatched larva is yellowish-red in colour, with a whitish-yellow band on the three larger abdominal joints; from the second to the third day the body becomes of a vermilion color, while the pale band across the middle of the body becomes slightly darker. On the sixth day, the head and thorax change to a dusky tint, the abdomen is still of a vermilion colour, the pale transverse band is quite distinct, and two dark lines appear on the prothorax. Very little change except growth takes place until the insects are a month old, when the wing-pads are plainly evident. As growth continues, these enlarge, and the whitish central band becomes more or less obliterated. Shortly after this the final moult takes place. After shedding its skin, the Chinch Bug is of a pale pinkish colour throughout, the wings extending either the whole length of the body, or, in the short-winged type, only one half the length of the body, with pinkish veins. Soon after, two black dots appear on the wing covers, the head and thorax become darker in colour and finally black. The adult insect is an elongate-oval, with broadly rounded ends, about .15 in. in length, and its width about ¼ as much.

The head and thorax are black, entire surface except the wings minutely hairy, the wing-covers are milk white, with a triangular black scutellum between them in front, the whitish area giving it roughly the form of the letter X.

The first winged specimens were obtained August 11th, giving a life cycle of 54 days. Both species are single brooded, hibernating in the adult form. The long-winged form differs from the short-winged type in that when most of them have acquired wings flights of the adults occur, resulting in their dispersal through the fields, and these flights were first observed Sept. 5th and succeeding fine days.

Habits. The eggs are usually deposited on the leaf-sheath or ligule, but sometimes underground, on the finer roots. The newly-hatched larvæ for about the first week of their existence feed on the tender roots below the surface, and usually out of sight. They may so feed for a month, for I have taken specimens very delicate in body and color, with the wing pads partly developed, and on exposure to light they would turn nearly black, almost immediately, but this must be regarded as exceptional. They seek the higher and drier portions of a field, for a wet location is detrimental to Chinch Bug progress. Hence it is the poorer condition a field is in the more liable it is to serious injury, as where the growth is rank, or the crop in good health, little injury will result.

Food Plants. The principal plants which have suffered most are the meadow grasses generally; particularly is this true of timothy. Wheat, corn, and oats have been very slightly injured, and in no case except where such a field was adjacent to a meadow or pasture. This does not mean that they prefer the meadow grasses to other crops, but simply that grain crops have been very scarce, and the succulent nature of the grasses all through the summer has not caused them to migrate in search of food.

Area of Infestation. The infested area covers about 5 square miles, embracing altogether about 1,800 acres of pasture and hay land. These are what may be termed grass farms, where the greater part of the land is always in sod. On the other hand, where a regular system of rotation has been followed, and the land ploughed up every three or four years, Chinch Bugs were very scarce, except in a small woodland pasture, which was not deemed advisable to cultivate. Under the present system of grass farming, Chinch Bug injury is likely to be on the increase, unless we should be favoured with an open winter, or a wet summer, as heavy rains at hatching time are disastrous to Chinch Bug progress. Such a season as we have experienced this year has materially reduced their numbers. Wet weather at hatching time was a severe check to undue increase, and this was followed later on in the season, in September, by the appearance of the white fungus *Sporotrichum globuliferum,* which killed about 25 per cent. at least.

The White Fungus. Inasmuch as the fungus is dependent upon suitable meteorological conditions for its growth, it is sufficient to place it in the second or third place as a suitable remedy for Chinch Bug extinction. In the latter part of May I attempted to reproduce this fungus artificially. I am indebted to Mr. P. A. Glenn, of the Illinois Experiment Station, for a pure culture of this fungus. Suitable tight boxes were taken, approximately 2 ft. long, 1 ft. wide and 14 in. high. Into these boxes soil direct from the field was introduced. In one box the spores of the fungus were introduced and thoroughly mixed with the soil, while the other was used as a check. It must be borne in mind that neither soil nor boxes were sterilized. Two to three inches of soil was placed in the boxes, thoroughly moistened and about half a pint of bugs introduced to each box, and fresh food was

introduced as often as necessary. It is not necessary to cover the box, a broad, heavy chalk line near the top of the box is sufficient to impede their migration. In the infected box the first diseased specimens appeared six days after introduction, seven specimens being found, all mature and probably "spent" bugs. No other specimens were obtained until 14 days after introduction, when 16 specimens were found to be diseased. The experiment was carried on for a month, with no other appearance of diseased bugs. In the uninfected box, not one diseased specimen was obtained. Through the whole month the weather was extremely cool, and this can be the only reason why the experiment was not a greater success.

Remedies. As the Chinch Bug hibernates under rail fences, tree trunks, tufted grasses, leaves, and rubbish of all descriptions, the advantage of what may be termed clean farming, and regular rotation is at once suggested. As far as practicable burn over all waste places in the fall as late as possible, so as to expose them to the rigours of the winter. To be effective, the burning must be done thoroughly, otherwise little or no good will result.

As most of the meadows infested are adjacent to woodlots in which the greater part of the bugs hibernate, it seems reasonable to believe that if a strip of land next the woodlot was ploughed in the early fall, and planted to wheat, it would serve as an excellent bait crop for the bugs coming out of their winter quarters. An inviting food would be at first hand, the eggs would be deposited on the wheat plants, where they could be promptly destroyed, bugs and all, by efficient ploughing and immediately rolling the ground.

To eliminate the Chinch Bug from a badly infested meadow is practically an impossibility, and, where the injury has been severe, the only recourse is to fall plough the land and plant the same to a hoe or leguminous crop.

Should the bugs be numerous in a wheat or oat field, they may be trapped as follows: Previous to the harvesting of the grain, a swath should be cut around the infested field, and a space cleared with a hoe about 1 ft. wide. Post holes should then be dug about 12 in. to 16 in. deep, and about 30 ft. to 35 ft. apart. As soon as harvest starts a thin line of No. 7 asphalt road oil should then be poured on the clear surface, touching the outside surface of the holes. As harvesting proceeds and the bugs are threatened with starvation they will commence to migrate from all parts of the field. As soon as they encounter the asphalt barrier they will be forced by sheer numbers into the post-holes, when they may be promptly destroyed by pouring in a little kerosene. To cite an instance of the efficiency of this method, it may be stated that last year with 1½ barrels of oil round a 10-acre field of badly infested wheat, three bushels of Chinch Bugs were collected in eight days in a field close to Carbondale, Illinois. When a corn field is adjacent to a pasture or hay field, where the bugs are somewhat numerous and migrating on to the field of corn, they may be killed by spraying the corn with a ten per cent. solution of kerosene.

A little caution is necessary in using this substance. Do not pour the solution into the heart of the plant, and spray preferably early in the morning or late in the afternoon, otherwise the foliage may be burned. Unless the corn is vigorous, the kerosene emulsion is not recommended, but in its place use the following mixture, which is absolutely safe, but slightly more expensive.

2 ozs. soft soap.
½ oz. black leaf 40 (40 per cent. nicotine).
1 gallon soft water.

Heat the water to near boiling, thoroughly dissolving the soap, then add the nicotine solution.

As the bugs injure the plant by sucking its sap, each bug must be hit by the spray before it will succumb.

EVENING SESSION.

TUESDAY, NOV. 19TH, 1912.

A public meeting was held at 8.15 o'clock p.m. in the Normal School, which was well attended by many visitors from the city as well as members of the society. The meeting was opened by the Hon. Martin Burrell, Minister of Agriculture, whose entertaining and humorous address was much enjoyed by those present. He introduced the speaker of the evening, Mr. F. W. L. Sladen, who was recently appointed to the staff of the Division of Entomology, as Chief Assistant in Apiculture, in which subject he is a leading authority. The subject of his address, "Bumble-bees and Their Ways," is one to which Mr. Sladen has devoted many years of careful study. The lecture was illustrated by many beautiful lantern-slides and was most interesting and instructive.

BUMBLE-BEES AND THEIR WAYS.

F. W. L. SLADEN, ASSISTANT ENTOMOLOGIST FOR APICULTURE, DIVISION OF ENTOMOLOGY, OTTAWA.

We have heard much of the wonderful instinct and industry of the honey-bee. But little has been told of the bumble-bee, the honey-bee's nearest relative in the temperate zone, and the only bee that shares with it the important distinction of living in communities. And yet, as I hope to show this evening, the bumble-bee is a most interesting and intelligent insect. We have not been fair to the bumble-bees. It is partly on account of its usefulness in supplying honey and wax that the honey-bee has attracted so much of our attention, and the result has been that we have neglected our beautiful bumble-bees. Our neglect of the bumble-bee is the less defensible because it, too, is a very useful insect in an indirect way. A great number of plants bearing long-tubed flowers, including that most valuable fodder plant, the red clover, depend for their existence on the bumble-bee, for it alone visits these flowers to any extent and fertilizes them, no other bees having tongues long enough to reach the nectar in them. In consequence of the absence of bumble-bees in New Zealand the farmers there were unable to get their clover to produce seed in any quantity. Bumble-bees were, therefore, imported from England in 1884, and two species, *Bombus terrestris* and *B. ruderatus,* were immediately acclimatised. As soon as these became plentiful the clover produced an abundant crop of seed, and has been doing so ever since.

Students of the honey-bee ought to be specially interested in the bumble-bee, for in many respects it shows an organization and civilization leading up to that of the honey-bee, yet, and here is an interesting point, it is not midway between the solitary bees and the honey-bee, but has developed on its own lines, and in its own particular sphere is as perfect as the honey-bee is perfect in its domain.

In the bumble-bee, as in the honey-bee, the female sex has two forms, a reproductive form called the queen and an industrious form called the worker. The queen is larger than the worker.

Each colony contains one old queen which is the mother of the workers, of which the major part of the population is composed. In the honey-bee the queen is much more differentiated from the worker than in the bumble-bee. The honey-bee queen is little else than a machine for laying eggs in enormous numbers. She cannot gather food and is even unable to feed herself adequately. She is extremely helpless and is always surrounded by the workers, who minister to her every want, for, left alone, she would die. Her young are cared for by the workers. She takes no part in feeding and nursing them. Her sting has lost its use as a weapon except for combating rival queens.

But the bumble-bee queen is a much less specialized and more capable insect. She has not sacrificed her instincts of industry, self-preservation, and affection and care of her young to the god of reproduction like the honey-bee queen. Indeed, the *role* she has to to play as the foundress of a large establishment containing a quantity of juicy maggots, pollen, and honey, attractive food for a host of animals ranging from mammals, such as badgers, weasels and shrews down to insects and mites, some of which exist solely as parasites on the bumble-bee and her brood, has sharpened her wits and we find her far more intelligent, industrious, and attentive to her brood than any other bee, if not any other insect. In fact, the care she bestows on her young is comparable with that shown by birds and mammals.

Let us trace briefly the life history of a queen bumble-bee. It is no long monotony, but is divided into stages, in each of which different instincts are brought into play.

The males and queens are reared towards the end of summer when the colony is at the height of prosperity. The first important event in the queen's life is her marriage, and this is preceded by a short courtship. The males hover around trees and banks, pausing in certain places to emit a fragrant scent like the odour of flowers. It seems very probable that the queens are attracted to these spots by their fragrance, at any rate they meet their mates, and each pair flies away to enjoy a brief honeymoon. The male, small and insignificant as he is, then ceases to be useful and soon dies, and the queen immediately enters on the second stage of her career, which is to find a hibernacle in which to pass her long winter sleep. In England several of the common species burrow into the ground. The queen chooses a slope facing north or north-west, consisting of a well-drained and friable soil and buries herself to a depth of about two inches, seldom more. It is evidently damp and not cold that she seeks to avoid. Indeed, the northern aspect shows that she prefers a chilly site, and one may guess that the reason is that she does not wish to be disturbed by the sun's rays too early in the spring before plenty of flowers are out and continuous warm weather may be expected. Other species find sufficient protection in out-buildings and under subbish heaps. Possibly in the severer climate of Canada the burrowing queens go deeper into the ground. As soon as the queen has settled herself in her winter quarters she falls into a torpor, which as the cold increases grows deeper and she lies like one dead. The dark and cheerless months pass and in April—some species wait till May and even June—she awakes and quits her grave. Keeping herself active and warm with the nectar she sucks from the willow-catkins, maples, and other flowers, she soon looks for a place in which to establish a colony. In England this is almost always a nest that has been made and afterwards vacated by field-mice, voles, or

other small mammals. Some of the species of bumble-bees select a nest situated in thick grass. Others, and these comprise the larger number, prefer to live underground with a long and winding tunnel leading to the nest. Occasionally a bird's nest in a hollow tree is chosen, and a nest between the double walls of an outbuilding meets the taste of some species. I once found a nest in an old shoe and another in a rusty kettle lying on a rubbish heap overgrown with weeds.

The queen teases the material in the centre of the nest with her legs and this makes it very soft and dry. Then she crawls into the middle of it and tramps it down, forming a warm and cozy cavity. Here she accumulates a lump of pollen about the size of a pea, and on this lump she lays her first batch of eggs which number about a dozen. The eggs are laid in a little cell of wax which is constructed on the top of the pollen, and after they have been laid the cell is sealed over with wax.

The process of pollen collecting is very interesting. The pollen dust gathers in the long body hairs with which all bumble-bees are densely clothed, and it is brushed out of these by the middle legs and conveyed to the mouth where it is moistened with honey. The moistened pollen is then transferred to a particular spot on the bristly inner side of one of the joints of the hind leg called the metatarsus or planta. This is really the first joint of the foot. The next joint above the metatarsus, namely the tibia, is provided at the end on the inner side with a comb which is used to scrape the moistened pollen off the metatarsus of the opposite leg into a receptacle at the end of the tibia. When the leg is straightened a projection on the base of the metatarsus enters the receptacle and pushes the pollen out of it on to the outer side of the tibia. As the result of many such contributions the well-known pellet of pollen is formed on the outer side of the tibia, and it is held in by a wall of stiff hairs surrounding it and acting like the stakes that farmer places around his wagon when he desires to carry hay. Two or three stiff hairs stand in the entrance to the pollen basket. The object of these seems to be to form a means of attachment for the pollen before a sufficient quantity has accumulated to be held by hairs at the sides.

In the honey-bee the pollen collecting apparatus on the hind legs is essentially the same, but it is more specialized. The moistened pollen is spread over the whole of the inner side of the metatarsus, the bristles there being arranged in ten transverse rows, and they hold the pollen in greater quantity, while the comb on the end of the tibia used for scraping it out of them is a very efficient instrument. Its efficiency is enhanced by the fact there are no spurs on the end of the tibia in the honey-bee, though these are present in the bumble-bee and all the solitary bees and are useful to these in performing their toilet.

It was formerly believed that a bee hardly ever visited more than one species of flower on the same journey, but careful observers have found that under certain conditions changing from one species to another is not rare, and this has been proved by the presence of variegated loads of pollen. Bumble-bees are more inclined to change from one species of flower to another than honey-bees. This is especially true in the case of the common European species *Bombus terrestris,* which is closely related to the Canadian species *B. terricola.* In a nest of *B. terrestris* that I kept under observation in July this year, 40 per cent. of the workers returned home with variegated loads. In order to discover exactly how the pollen basket is loaded I took sections of a number of the variegated loads collected by the workers in this nest. In one of the most interesting of these, no less than eight successive kinds of pollen were distinguishable. The sections showed clearly

that after the pellet had reached a certain size every fresh lot of pollen contributed is forced in as a wedge between the pollen previously gathered and the surface of the tibia. The growing lump is occasionally patted by the middle leg to keep it in shape.

The wax of the bumble-bee is secreted by glands situated beneath the membranes connecting the segments of the upper side of the abdomen, not in the underside of the abdomen as in the honey-bee. It is much inferior to beeswax, being soft and sticky, and its color is brown. It varies in tint and softness according to the species. It is scraped off the body with the brush on the inner side of the hind metatarsus, and worked up with the mandibles.

To return to the commencing nest. The queen next begins to construct a waxen cell or honey-pot to hold the honey she collects. It is always formed in the entrance to the nest. When finished the pot is large, being about ¾ in. in diameter. It is very fragile but it remains watertight for about a month, which is as long as it is needed. The picture is from a photograph I took of a honey-pot of *Bombus lapidarius*. In fine weather the queen is so industrious that she fills the honey-pot to the brim with thin nectar in two or three hours, and this is sufficient to feed her throughout the night.

A constant supply of nectar enables the queen to maintain continuous animation and so to incubate her eggs, which need to be kept warm for three or four days before they hatch. The larvæ, always hidden under their waxen covering, are fed by the queen with a mixture of honey and pollen. She churns up the mixture in her honey-sac, makes a hole in the wax covering with her mandibles, spues out the food amongst the larvæ and then closes the hole. The larvæ also feed upon the pollen on which they rest.

In eleven days from the time the eggs were laid, the larvæ, still covered with wax, are full grown and spin their oval cocoons. From these the perfect bees emerge about 22 days after the eggs were laid, that is to say, if the queen has been able to incubate the brood continuously, but a few days longer if, through stress of bad weather, it has been allowed occasionally to get chilled. As the brood approaches the time of hatching the queen becomes doubly devoted to it, and she sits for hours spreading her body to nearly twice its usual length over it. At this stage molestation makes her buzz angrily and cling closely to the brood, whereas at an earlier stage it would frighten her and probably make her desert. It is interesting to note that these first larvæ arrange themselves and spin their cocoons in such a way as to derive the greatest heat from the queen's body, those at the sides being at a higher level than those in the middle; thus a groove is formed just the size of the queen's body and here she sits. This groove, I notice, runs in the direction of the honey-pot, never in the opposite direction across the nest.

This first brood consists entirely of small workers which help the queen to gather food and to incubate and feed the succeeding batches of brood that develop from the eggs that the queen now lays in increasing numbers. These eggs develop into workers larger and more capable than the first. The queen henceforward remains at home devoting herself to egg-laying and other home duties and so she enjoys a well-earned rest from the labour of gathering food, a fitting reward for having, single-handed, brought the colony into being through long and patient labour.

The colony now becomes busy and prosperous and honey is stored in the vacated cocoons and also in waxen honey-pots specially constructed to receive it.

Pollen is also stored in the old cocoons or in specially constructed waxen cells, which are by some species attached to the bunches of larvæ. The photograph here shown is of a nest of *Bombus lapidarius.* Notice the wax-covered bunches of larvæ, the clusters of cocoons and the waxen honey-pots filled with glistening honey. In one place an old cocoon containing pollen may be seen.

The number of workers produced varies according to the species. In some of the underground dwelling species, for instance, *Bombus lapidarius,* it amounts to about 300, while in some of the surface nests it does not exceed 60. The males and queens are reared after the workers, and they leave the nest as soon as they are fledged. By this time the workers are getting old and worn and they die off rather quickly. Finally the old queen herself perishes, but this event is often preceded by a kind of Indian summer in which, having no more eggs to lay, she becomes quite lively and youthful looking again. Death, when at last it comes, is probably painless. A cold night and an empty cupboard caused torpor, as it did on many occasions in the early part of her career, but this time there is no awakening. And so ends the recently busy community.

Bumble-bees have many enemies. Perhaps the greatest are of their own kind. In the case of two of the commonest British species, *Bombus terrestris* and *lapidarius,* a queen finding a commencing nest of her own species attaches herself to it. The old queen remains friendly with the intruder until she has eggs to lay. Then a battle royal takes place and one of the queens stings the other to death. I have found as many as twenty dead *terrestris* queens that have been killed in this way lying under a *terrestris* nest. There is a whole genus of lazy bumble-bees named *Psithyrus* whose nature it is to prey on the industrious bumble-bees in much the same way. Each species of *Psithyrus* preys on a particular species or group of species of *Bombus.* The *Psithyrus* is destitute of the pollen-collecting apparatus on the hind legs and is quite incapable of establishing a nest and providing food for her young. She is a heavy, lazy, dark-winged individual. Her skin is exceedingly thick and hard, the plates covering the abdomen fitting closely over one another, forming a coat of mail to protect her from the stings of the *Bombus* queen. She prefers to find the *Bombus* nest when a few workers have hatched. Here she devotes herself to winning popularity, and as soon as she finds that sufficient eggs have been laid to produce a good number of workers she murders the unfortunate *Bombus* queen and compels the workers to become her slaves and rear her young, for she produces no workers of her own kind, only males and queens.

Sometimes the *Psithyrus* fails to find the *Bombus* nest until many workers have hatched. These attack her furiously and generally succeed by long-continued efforts in killing her by stinging her in some joint between the harness, such as the neck or insertion of the wings. It is a remarkable fact that the *Psithyrus* queens do not fight among themselves. Should more than one find the same nest the others slink off to search for other nests, leaving the first one in possession. Should a *Psithyrus* queen find a nest of a different species of *Bombus* to that on which she naturally preys she lodges in it night after night, compelling the *Bombus* to share with her the food the latter has collected until she finds a nest of her true host. Another striking fact is that the *Psithyrus* usually resembles in colour the species of *Bombus* on which it preys. This mimicry cannot be for protection from the *Bombi* for they meet only in the nest where it is quite dark. Probably the mimicry is due to the slightly greater protection from the attacks of birds, most of which avoid bumble-bees, afforded by donning the warning livery of their more

abundant and better recognized hosts. By so doing the *Psithyrus* passes as one of them and does not attract any particular attention when associating with them. Coloration is very unstable in many species of *Bombus* (and *Psithyrus*), for instance, *B. lapidarius,* which in England is black with a red tail, has in many parts of Europe three bright yellow bands as well, and there is a strong tendency towards convergence in different regions. In north-eastern Europe the convergence takes the form of melanism. In Canada, dingy yellow with a black band or two and occasionally a belt of red across the abdomen, is the favourite pattern, while in the Caucasian Mountains the yellow bands turn white.

I have made several attempts at domesticating bumble-bees. One of the most successful of these has been by the use of an artificial domicile made by digging out a cavity in grassy ground with a trowel and placing an artificial nest made of dead grass in it. A wooden cover with a tin plate rim is placed over the nest and a tunnel is made for the bees to go in and out with an iron implement driven through the ground with a mason's hammer. This device has attracted the queens of *Bombus lapidarius* in great numbers and also a few queens of several other species. It might be successful in this country with some of the plentiful species.

For studying the habits of bumble-bees I have, during the past two years, employed a wooden hut on the shelves of which I have placed my nests in little wooden boxes covered with glass. Each nest communicates with the outside by means of a special wire tube, up and down which the bees soon learn to pass. When the nest is small, one small box will hold it, but as it grows a larger one is placed on top and later a third one, still larger, is added. For strong nests a fourth box is needed. To keep the nest sweet and clean it is necessary to place a tray containing earth between the nest box and the end of the wire tube. A sheet of glass is placed over the tray and the entering and departing bees can be observed passing under it. The next slide shows a comb of *Bombus terrestris* built in one of these nest boxes. In these boxes we can see everything that the bumble-bees do in their nest, such as constructing the cells, depositing honey and pollen in them, the feeding of the young, the laying of the eggs, the spirited defence of the new-laid eggs by the queen against the attacks of the workers who endeavour to devour them, the hatching of the young bees, which are often assisted by their older sisters in their struggles to get out of their cocoons, and many other details.

Bumble-bees occur further north than honey-bees. As they do not have to store honey for the winter they can exist where the season is short and flowers comparatively scarce. The light nights of the arctic are an advantage to them, for they work on the flowers as long as they can see and their furry coats help them to withstand the cold. In the collection of bumble-bees at the Central Experimental Farm, Ottawa, are some specimens from Nottingham Island, in the Hudson Strait. Species have also been recorded from the Boothia Peninsular, and I have seen a specimen from Melville Island. There can be no doubt that bumble-bees inhabit almost the whole of Canada, and that they play an important part in the preservation of the native flora. Several unknown species probably occur in Northern Canada and I am anxious to get specimens of these for our collection, while specimens from the better known regions, provided they are sent in sufficient numbers, are also likely to include interesting varieties and possibly novelties.

The red clover, which is almost exclusively fertilized by bumble-bees, is an important fodder crop to the Canadian farmer. In the Ottawa district there seem to be more than enough bumble-bees to fertilise the red clover, but Mr. Morley

Pettit, the Provincial Apiarist, tells me that in some parts of Ontario bumble-bees are scarce, and that a farmer in one of these districts got a splendid crop of red clover seed by procuring nests of bumble-bees and putting them around the field.

At the close of the lecture a vote of thanks to Mr. Sladen for his interesting and instructive address was proposed by Mr. Grisdale and seconded by Prof. Lochhead.

SECOND DAY'S SESSION—WEDNESDAY, 20th, 1912.

At 9.15 a.m. the members met in the Carnegie Library, and the session commenced with the election of officers for 1912-1913. A list of these is given on page 6.

An interesting address was then delivered by Mr. J. H. Grisdale, Director of the Dominion Experimental Farms, who spoke of his early entomological associations and of his warm friendship for the late Dr. James Fletcher, by whom his first real interest in entomology was awakened. He referred to the importance and value of the work that is now being done in economic entomology in Canada, particularly by the Division of Entomology, and of the rapid development of the Division since the appointment of Dr. Hewitt as Dominion Entomologist. He expressed his keen interest in the work of the Society, and his readiness to do anything in his power to assist in the advancement of economic entomology.

The remainder of the forenoon and the afternoon were devoted to the reading and discussing of papers, all of which appear in the following pages.

Dr. Hewitt: Owing to Mr. Tothill's illness, I shall read his paper, as I am naturally well acquainted with the work which Mr. Tothill has been carrying on.

As I told you when we last met, we proposed to start the introduction into Canada of such parasites as we could obtain of the Brown-tail and Gipsy Moths. Experiments in this direction are now being carried on and this season we have instituted field stations for the purpose; one has been established in New Brunswick and one in Nova Scotia. Mr. Tothill's work in New Brunswick has been directed especially to the question of the introduction or the possibility of the introduction of parasites of the Brown-tail Moth. The Brown-tail Moth in New Brunswick has spread over a very large area during the past two seasons, and it seems to us that the only method of combatting this pest was to import the controlling parasites of the insect. With that object in view, I made arrangements with Dr. Howard, of the United States Bureau of Entomology which, as you know, during the past few years have been importing from Europe and Asia parasites of the Gipsy Moth at an enormous expense. We are, therefore, able to make use of the results of the work of the United States Department of Agriculture in this connection, in view of Dr. Howard's willingness to assist us in this manner. One of the two insects that we could make use of is a Carabia beetle which is predaceous on the Brown-tail and Gipsy Moth larvæ. It also feeds on the caterpillars of certain other native insects. You will thus realize that this insect is extremely useful on this account. Therefore, we decided to import that insect as one of the two valuable enemies in checking the Brown-tail Moth. The other insect parasite is a fly, a Tachinid, which Mr. Tothill has studied specially; this is parasitic on the larvæ of the Brown-tail Moth and the Gipsy Moth and other native insects. Mr. Tothill's paper is as follows.

PROGRESS OF THE INTRODUCTION OF THE INSECT ENEMIES OF THE BROWN-TAIL MOTH, *EUPROCTIS CHRYSORRHOEA* LINN. INTO NEW BRUNSWICK AND SOME BIOLOGICAL NOTES ON THE HOST.

J. D. Tothill, Division of Entomology, Ottawa.

During the season just closed a beginning was made at the suggestion of and under the general supervision of the Dominion Entomologist, Dr. C. Gordon Hewitt, in the introduction into New Brunswick of the insect enemies of the Brown-tail Moth. Owing to the fact that the host insect is at the present time exceedingly scarce in the Province, attention has been necessarily confined to the introduction of facultative rather than obligate species. Of these facultative species, special effort has been made to introduce two spcies both of which are native to Europe and both of which have become established, through the efforts of Dr. L. O. Howard, Chief of the United States Bureau of Entomology, and his assistants, in Massachusetts. Each of these species has abundantly proven its practical worth in Massachusetts as a valuable factor in the natural control of both the Brown-tail and Gipsy Moths.

These insects are respectively the Tachinid parasite *Compsilura concinnata* Meig, and the predatious ground beetle *Calosoma sycophanta* Linn.

In order to secure a supply of the Tachinid fly, a journey was made by the writer to Boston during the first week of July. This resulted in the collection of 12,000 caterpillars of the Gipsy Moth from points in Massachusetts where the parasite was known to be plentiful. These caterpillars were placed in Fiske trays and through the kindness of Mr. A. F. Burgess were given quarters at the Gipsy Moth Parasite Laboratory at Melrose Highlands. Within ten days' time the very satisfactory total of 2,395 puparia of *Compsilura* was obtained from the trays; these were picked out of the trays from time to time and sent by mail to Fredericton.

The shipments arrived at Fredericton in excellent condition, and there were sufficient puparia for the establishment of two strong colonies. Suitable localities were found near St. Stephen and Fredericton respectively, and consequently these two places served as the liberating points for the parasites. After the time for the issuance of the adult flies had expired the puparia were examined, and it was found that about 75 per cent. had successfully given the adult; this gives a total of about 850 adult flies for each colony.

In the case of the Fredericton colony an observation was made demonstrating the fact that this Tachinid is a strong flyer and is capable of rapid dispersion. At a point three miles from the point of liberation as the crow flies, some caterpillars of *Hyphantria cunea* were collected and subsequently dissected; these were found to contain first stage maggots of *Compsilura* so easily recognized in this stage by the presence of anal hooklets and by the feeding locality. The observation is of special interest in that the female fly responsible for the three maggots had, in order to find the particular caterpillars, to cross the River St. John, which at the place is almost three-quarters of a mile wide. Thus a fertilised female fly of *Compsilura* is capable of flying three miles, including a body of water, almost three-quarters of a mile wide before the completion of larviposition.

In regard to the predaceous ground beetle *Calosoma*, a single shipment was received on June 11, through the kindness of Dr. L. O. Howard, and Mr. A. F.

Burgess. It consisted of 80 adult beetles collected in the field near Melrose Highlands, Massachusetts. All were in excellent condition on arrival and were immediately paired off, each pair being placed in a glass breeding jar partly filled with earth.

Breeding operations were continued throughout the summer, but with only fair success, as the season was unusually cold and wet, the liberal supply of food necessary for strenuous reproduction was found to be hard to maintain, and it seems likely that most of the beetles were young ones (1 year old) which normally have a very much smaller reproductive capacity than old specimens (2 years old). Sufficient larvæ were reared, however, to enable an experiment to be planned with the view of finding out whether or not these insects in the pupal state will survive the boreal winters of New Brunswick.

Toward the end of the breeding season a small colony of the adult beetles was planted near St. Stephen, and the remainder of the beetles, some fifteen pairs, were allhowed to go into hibernation under laboratory, but at the same time natural, conditions at Fredericton. These latter will afford data on the subject of hibernation of the adults under New Brunswick conditions.

Next spring, therefore, exact data will be available on the ability of *Calosoma* to hibernate in both the pupal and adult conditions in this Province. Should hibernation prove successful in both conditions it will be possible to conduct extensive breeding operations at the laboratory next summer.

The remarkable success which has attended the introduction of *Calosoma sycophanta* into Massachusetts leaves it to be sincerely hoped that the insect may flourish equally well in boreal as in transition zones. On visiting Massachusetts this summer this insect was more in evidence than any of the several insect enemies of *E. chrysorrhoea* and *P. dispar* that have been introduced up to date. The writer had occasion to examine several hundred burlaps within a radius of five miles of Melrose Highlands and it was no uncommon occurrence to find five or more *Calosoma* larvæ under a single burlap, while it was quite uncommon to find a burlap without any of the larvæ.

Before leaving the subject of *Calosoma,* the opportunity may be taken to record an American parasite of this European insect. One of the adult beetles soon after its arrival from Massachusetts died. It was opened up and found to contain four Tachinid larvæ. Two of these were reared through to the adult state and proved to be *Biomyia georgiæ* B & B. This insect is recorded* as a parasite of two native Calosomas namely *C. calidum* Fab. and *C. peregrinator* Guér.

In addition to *Calosoma* and *Compsilura* there are four more insect enemies of the Brown-tail Moth, all true parasites, known or suspected to be in New Brunswick. The ones known to be in the Province are respectively the egg parasite *Trichogramma sp.* reared last year by Mr. George Sanders of the Division of Entomology from eggs of the host secured in Charlotte County; and the Tachinid fly *Phorocera leucaniæ* Coq., a puparium of which was secured this summer from a host caterpillar mailed to the laboratory by Mr. P. N. Vroom from Charlotte County. Both of these are native insects. The two species suspected to be in the Province are *Pteromalus egregius* Först. and *Monodontomerus aereus* Walk., both of which through the efforts of the United States authorities were introduced into Massachusetts a few years ago and both of which have recently been found in the State of Maine not far distant from the New Brunswick border.

*J. M. Aldrich, *Cat. N. A. Diptera, 1905, p. 448.*

The presence in, or in proximity to the Province of New Brunswick of these four parasites naturally suggests the question of whether or not the insect enemies of the Brown-tail Moth now established in Massachusetts will be able to withstand the colder winters of New Brunswick; the change involved is of course from the transitional to the boreal life zone (these as recognized by Dr. C. Hart Merriam). No definite statement can be made at the present time either one way or the other. At the same time, considerable evidence bearing upon the subject has accumulated, all of which supports the theory that the insect enemies introduced from Massachusetts will flourish equally well in New Brunswick: the native *Phorocera* and *Trichogramma* are known to be parasites of the Brown-tail Moth in both Massachusetts and New Brunswick; the imported *Pteromalus* and *Monodontomerus* by natural spread from Massachusetts have almost if not quite reached the borders of New Brunswick; the host insect has shown itself adapted to the climate of Massachusetts and New Brunswick, and an insect with a wide climatic range may be reasonably expected to carry a sequence of parasites with the same range: and finally by making a study of the parasites of *Hyphantria* in both places, the writer has found that the sequence of parasites on that insect in each place is precisely the same, and if the parasites are the same for *Hyphantria* in both places analogy would argue them the same for *Euproctis*.

In regard to the Brown-tailed Moth itself it was found that the life history of the insect in New Brunswick differs at the present time in two points of considerable economic interest from the life history in Massachusetts; these two points are (1) in the selection of the host plants and (2) in the number of eggs deposited by each female.

In the matter of host plants the bringing together of the host records of all the winter nests found in the Province during the winter destruction work of 1911-12 shows that pear, plum, and willow trees, which are favorite hosts in Massachusetts, are scarcely attacked in New Brunswick. The following table serves to illustrate the point:

List of Trees and Shrubs on which Nests are Found.

Host.	No. of B.T. Nests.	% of total nests.
Apple	2,196	89.55
Pear	1	04
Plum	13	51
Choke Cherry	45	1.83
Pennsylvania Cherry	12	48
Maple	11	44
Bilberry	80	3.26
Elm	15	61
Oak	2	08
Willow	1	04
Poplar	1	04
Thorn	73	2.97
Beech	2	08
	2,452	100.00 approx.

The column at the right hand side indicates the percentages of the total nests that were found on the particular hosts. It will be seen that nearly 90 per cent. of the total nests were found on apple, 3.26 per cent. on bilberry, 2.97 per cent.

on thorn, and so on down the list, whilst only a very small per cent. were found on pear, plum and willow. In the case of pear and plum the explanation is readily found in that, whilst these trees are plentifully grown in Massachusetts they are rarely met with in New Brunswick. In the case of willow, however, the same explanation will not hold, as in the Province of New Brunswick willow trees are quite plentiful, especially along the banks of rivers and streams, and the species are almost certainly the same as those found in Massachusetts—yet only one nest out of a total of 2,452 was found on willow!

Two reasons for this suggest themselves, one of which is found in the origin of the New Brunswick moths. It has been abundantly established that the prevailing north-easterly winds have played an important role in the distribution of the pest on the North American continent; and moreover it is reasonable to suppose that moths hatched out on high lands have been more subject to this method of distribution than those hatched out in valleys and sheltered places. The primary supply of moths in New Brunswick was therefore probably blown into the country from the high lands or 'ridges' of the adjoining State of Maine. The host plants on these high lands are conspicuous, arguing from the similar conditions of Charlotte County, New Brunswick, by an absence of willow, and would be made up largely of apple, bilberry, choke-cherry and thorn. This at least partially accounts for the absence of New Brunswick nests taken on Salix.

Another reason may probably be found in the tendency of the moths to breed back or lay their eggs upon a host plant of the same species upon which their respective caterpillars were reared. This 'breeding back' is a well-known and well-established trait among certain *Lepidoptera* with a choice of food plants, and there seems no reason for supposing that *E. chrysorrhoea* is not subject to the tendency. If the insect is subject to the tendency it would not be expected, in view of the scarcity of Salix in the localities from which the New Brunswick supply of moths originated, that willow would be selected as yet in the Province as a food plant.

These two factors working either separately or more likely together seem to be sufficient to account for the peculiar difference in the food habits of the moth in New Brunswick and Massachusetts. As the insect increases in the Province, and food plants become relatively scarce there will probably be developed a strain depositing eggs on willow—and also on elm.

Before leaving this subject of host plants it may be pointed out that just as the lack of nests found on Salix can be explained so and in precisely the same manner can the abundance of nests found on apple, bilberry, thorn and choke-cherry be explained. From these four host plants was bred the original stock that was blown into New Brunswick; the moths found themselves blown onto the 'ridges' of Charlotte County where plants of the same species were abundant; the tendency to breed back onto the original host plants was present; and the result was that 97.61 per cent. of all the nests found in N. B. in the winter of 1911-12 were taken on apple, bilberry, thorn and choke-cherry.

In regard to the egg laying capacity of *E. chrysorrhoea,* there was found to be a decrease in New Brunswick as compared with Massachusetts of 110 less eggs per female. In 1907, Mr. A. H. Kirkland* had 389 winter webs collected at various points throughout the then infested district and examined; these gave an

*A. H. Kirkland, Third Annual Report of the Superintendent for Suppressing the Gipsy and Brown-tail Moths, Boston, 1908, pp. 168-169.

average larval content of 286 per web. This spring (1912) the writer instigated an examination of 121 webs collected at various points in New Brunswick; these gave an average larval content of 175.81 per web, or approximately 110 less larvæ per web than in the case of the more southern relatives and progenitors.

This discrepancy probably appears slightly greater than it actually is on account of the fact that as the total number of feathered enemies apparently remains unchanged, while the total number of caterpillars becomes greater it would naturally be expected that birds would be responsible for a greater mortality of the wintering larvæ in the thinly infested Canadian area than in the thickly infested American one. Also Mr. Kirkland's nests possibly contained a few more 'compound' ones than did the Canadian ones. These two factors, however, by no means eliminate the discrepancy.

The explanation of the discrepancy seems to be that the lighter females, i.e., those containing fewer eggs, have better chances of flying long distances and that it is therefore only such moths that have up to the present time succeeded in reaching New Brunswick. Lower temperatures may also possibly have a tendency to reduce the number of eggs laid, but there is no direct evidence in support of such a view.

The two points in the biology of the Brown-tail Moth that have just been mentioned are both illustrative of differences between the insect in Massachusetts and New Brunswick.

SAN JOSÉ SCALE IN NOVA SCOTIA.

G. E. Sanders, Division of Entomology, Ottawa.

In scouting for Brown-tail moth in the orchards of the Annapolis Valley during the season of 1910-1911 and 1911-12 the inspectors were, to a certain extent, on the lookout for San José Scale. As the San José Scale had never been reported from Nova Scotia, and the majority of the imported nursery stock came from Ontario, where it was considered that proper measures were taken to safeguard the buyer, the chances of finding Scale were thought to be very remote. Inspection during 1912, however, proved this opinion in regard to trees shipped into Nova Scotia to be very inaccurate.

On April 8th, while scouting the property of Thomas Wagner of Aylesford, some Stark trees of 1911 planting from Ontario were found to be moderately infested with what appeared to be dead San José Scale. It was plain that unless this was an exceptionally bad lot of trees, the finding of living San José Scale was only a matter of inspecting a large enough number, no matter how well the fumigating was carried on.

As the Brown-tail moth work occupied the time fully until May 1st, no time during that month could be spent in hunting for living Scale. The matter of finding dead Scale was reported to Principal Cumming, Provincial Secretary for Agriculture for Nova Scotia, through Dr. Hewitt, and he immediately published notices in the newspapers asking the owners of recently imported Ontario trees to report them and an inspector would be sent to examine the stock. In this way many lots of trees were reported and examined, but no living San José Scale found. In addition, the 1912 importation was examined as it arrived and it was the exception rather than

the rule to find a lot of trees arriving free from San José Scale. About 30 per cent. of all trees arriving from Ontario bore more or less San José Scale. In reconsidering the situation in the Thos. Wagner orchard at Aylesford, it seemed impossible that adult female scales should remain on the trees since the autumn of 1910, although the previous examination had revealed none living. On May 28th, these trees were examined for a second time, and three living Scales found on one tree. Principal Cumming was immediately notified, and on June 3rd, a mass meeting under the auspices of the Nova Scotia Fruit Growers' Association was held at Kentville, and recommendations were made by them that a force of inspectors at once be employed to examine all recent importations from Ontario and that regulations be framed governing the further importation of nursery stock

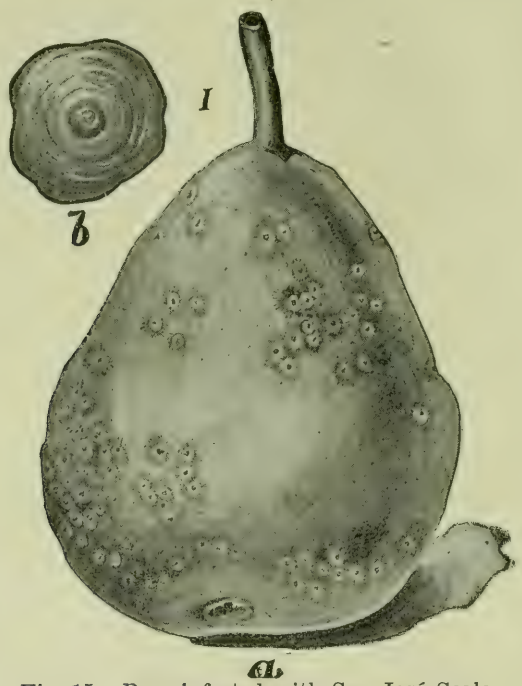

Fig. 15.—Pear infested with San José Scale.

into Nova Scotia. On June 4th, regulations were passed by the Province of Nova Scotia empowering their inspectors to destroy without indemnity trees infected with living San José wherever found, and such adjacent trees as they thought necessary. Application was made by Principal Cumming to the Ontario Nursery firms doing business in Nova Scotia for a list of their customers covering the years 1910-11-12, and the largest "jobbers" in Nova Scotia at once furnished lists of customers supplied with Ontario stock by them. With these lists to start with, the first of the inspectors started working systematically from Aylesford on June 5th. The inspectors formerly employed on Brown-tail moth were the first to be taken on, on account of their knowledge of the country and of dealing with the public, and it is mainly due to this fact, that the inspection was so successfully carried on. The number of inspectors from this date until Nov. 1st varied from six to twelve. The inspectors first devoted their attention to the districts where planting was heaviest and the orchard interests most important, viz., the district about

Middleton, Berwick and Kentville. As it could not be determined if the Scale on 1912 trees was living or dead the trees of 1911 planting were first examined. About one week after starting, living Scale was found on five trees of 1910 planting. This, together with the fact that the nurseryman's lists were very slow in arriving, and in some cases very inaccurate as well as incomplete, compelled a change of programme. The lists for the time were abandoned and a house to house canvass of the whole Annapolis Valley for trees of 1910-11-12 planting from any point outside of Nova Scotia. On the first inspection all trees of 1910-11 planting were carefully examined, and on the second inspection which started about July 20th, all trees of 1912 planting were carefully examined and infested plantings of 1910 and 1911 looked over for the second time. During September inspectors were sent to the districts lying near the Valley and to the counties of Digby, Yarmouth, Queens, Shelburne and Lunenburg, while the Chief Provincial Inspector with our assistant remained in the Valley to make a more thorough inspection of some plantings which were in doubt and to attend to complaints and reports of uninspected stock, etc.

Fig. 16.—Part of stem infested with San José Scale.

During the season, the whole western portion of Nova Scotia has been covered. Every suspicious tree of which any trace could be obtained examined, and every house in the Annapolis Valley between Windsor and Digby visited in the effort to locate all recently planted nursery stock. In all 157,065 trees of 1910-11-12 planting, distributed on 1,742 properties throughout Kings, Annapolis, Hants, Digby, Yarmouth, Shelburne and Lunenburg Counties were examined. The following table gives the results of the summer's work:

—	Total No. of properties carrying outside Nursery Stock.	No. of properties carrying stock infected with San José Scale living or dead.	No. of properties carrying living San José Scale.
1910.....	247	3	3
1911.....	699	71	71
1912.....	1,023	711	127
Total.....	1,742	785	201

Total number of trees examined	157,065
Number of trees of 1910 planting destroyed	7
Number of trees of 1911 planting destroyed	345
Number of trees of 1912 planting destroyed	341
Total number of trees destroyed	693
Percentage of total planting of 1910-11-12 destroyed	0.4414
Estimated percentage of trees of 1912 planting infected	30
Number of nurserymen shipping stock infected with living San Jose Scale into Nova Scotia	8

The infected properties were scattered over Hants, Kings, Annapolis, Digby and Yarmouth Counties or about 175 miles of territory. In most cases the trees showed signs of fumigation and a large proportion of the trees in 1912 plantings showed most of the Scale to be dead. It was common to find only one or two

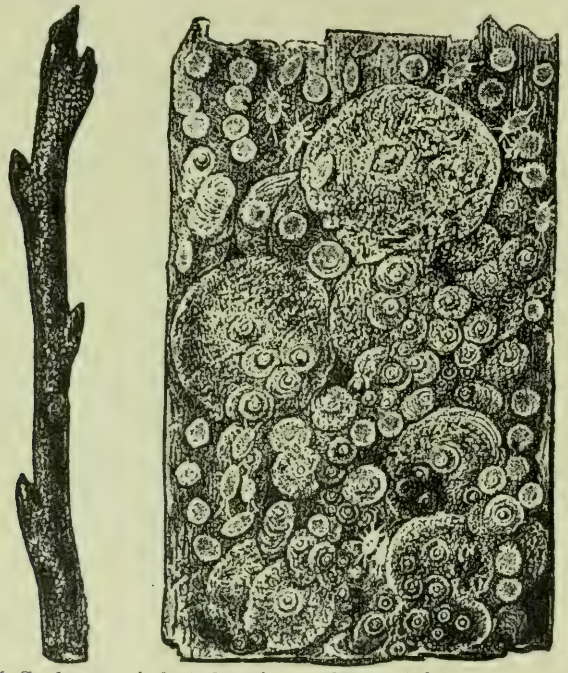

Fig. 17.—San José Scale; an infested twig, scales and larvæ on back much enlarged.

trees bearing living Scale in a lot of 100, while often 50 to 60 per cent. bore dead Scale. Only one lot apparently arrived in 1912, which had not been fumigated. Lots of one variety from one nursery almost invariably bore living San José Scale. Whenever Scale was present on this variety, it was alive, and on the more heavily infested lots there was no dead Scale beyond the ordinary winter-kill. In one lot of 100 of these trees the inspectors destroyed 35, the highest percentage found.

In closing, mention must be made of the high class of work done throughout by the inspectors and to the attitude of the fruit growers of the Valley to the work in hand. Soon after the work started, the Valley was flooded by letters from Ontario nurserymen, some assuring people that their trees were absolutely clean, that they had never had Scale in their nursery, and that if their trees bore Scale it had got on the stock after planting in Nova Scotia. Others cited well-known authorities to say that it was impossible for living Scale to be on their trees after the treatment they had received, and asked if they were sure that the inspectors

knew San José Scale. Others went so far as to assure people that the spray for San José Scale was of so much benefit to their orchard that it was a positive blessing; and that they could not understand why the inspectors destroyed the trees. On account of the previous work of the inspectors being well and favourably known, and the fruit growers knowing what San José Scale meant to them, once they were convinced that living Scale was present, they were ready to do all in their power to help in the work of eradication. The fact that on 200 of the 201 properties on which trees were destroyed, the owners assisted the inspectors in every way, and the most common complaint was "Why couldn't you get to my place sooner?" shows that the fruit growers of the Annapolis Valley are more alive to the danger from importing noxious insects than probably any other district in eastern America. On the other hand, that the inspectors dealt with such a number of people and in spite of nurserymen's assurances and no compensation for the trees destroyed, and in only one case were slight objections made which were done away with in a few minutes, speaks for their tact and the respect which they have gained.

At the present time it seems a possibility to eradicate the Scale in Nova Scotia, although the idea is scorned by most entomologists. However, the following points are in favour of eradication: The Scale is all on trees of 1910-11-12 planting. So far it has not been found spreading from the trees on which it was imported; the people of Nova Scotia will, to a man, do everything in their power to help in the work of eradication; and lastly, Dr. Matheson, who recently took the work in charge, has to assist him under H. G. Payne, Chief Provincial Inspector, the finest lot of inspectors the writer ever had the pleasure of directing.

Mr. Caesar: On what dates did you find the scales running?

Mr. Sanders: The first scales were found moving on the trees about July 10th, perhaps earlier.

Mr. Caesar: Are you sure? July 1st is the earliest date this year for the Niagara District, and Nova Scotia has a colder climate than Southern Ontario, where the San José Scale is found.

Dr. Hewitt: I should think there would be a difference of about a fortnight between Niagara and Nova Scotia.

Mr. Sanders: The scales were very abundant about the middle of July on the trees on which they were found.

Mr. Caesar: Were they 1912 trees?

Mr. Sanders: 1912.

Mr. Caesar: Did you find any trees on which the scale was moving later?

Mr. Sanders: Yes, as late as in August.

Mr. Gibson: What is the average date for Ontario?

Mr. Caesar: The average date is between June 10th and 30th.

Mr. Caesar: Do you think that, considering climatic conditions, the San José Scale is likely to be sufficiently serious in Nova Scotia to be of economic importance?

Dr. Hewitt: We cannot attempt to answer that question, and we should give no insect the chance to become of economic importance if such a likelihood is possible and it is in our power to prevent it.

Mr. Caesar: The reason I ask this question is that in Ontario the most northerly record for the San José Scale is Woodstock, and although trees infested with the scale have been planted year after year throughout Ontario, yet east of

Toronto, where there are many young orchards and where the scale must have been sent as well as to Nova Scotia, we know of no orchard that is infested with the scale. I know that temperature alone does not control the San José Scale; but it would seem very probable that it would not thrive in Nova Scotia, as it has been prevented from gaining a foothold in Eastern Ontario by climatic conditions.

Mr. Sanders: There are two things in favor of its becoming a serious pest in Nova Scotia: First, it survived the winters of 1910-11 and 1911-12, which were quite cold in Nova Scotia. The worst infected trees we had were of 1910 planting. One of the trees was very badly infested. Second, the lowest temperature in the United States, where the scale occurs, is 15-18 degrees below zero, and Mr. Caesar has said that the scale will survive a temperature of 22 degrees below.

Mr. Caesar: For a short time only.

Dr. Matheson: In Idaho the temperature sinks to 30 degrees below, at Binghampton 40 degrees below, yet the San José Scale survives. Nova Scotia is not very different in temperature from Western New York. I have had much pleasure in listening to Mr. Sanders' paper, and speak in high commendation of his work. It is my hope that the San José Scale may be speedily controlled.

Dr. Hewitt: The discovery of the San José Scale in Nova Scotia has been in a way responsible for the appointment of two Provincial Entomologists, Dr. Robert Matheson for Nova Scotia, and Mr. L. Caesar for Ontario. Mr. Caesar will have a serious task in dealing with the question in Ontario, on account of the great interests and the many difficulties which many nurserymen raise. I know it will be a hard task for the next few years to get things in good order. The regulations passed by Nova Scotia will have a beneficial effect generally. The inspection of nurseries in Ontario is absolutely necessary, and we know that the fumigation has been and is in many cases carelessly carried out. We have assisted in bringing about this requirement concerning inspection, whereby Ontario nurserymen will not be allowed to ship stock into Nova Scotia unless inspected and found free from scale. The work of Mr. Caesar in connection with this inspection service will be of much help in this problem which we have to face.

Mr. Caesar: Much information is still wanted in Ontario. I have been thinking over many nursery questions, and had planned a thorough study of this matter before I was appointed Provincial Entomologist and before the question in Nova Scotia came up. I have not been responsible for the inspection work up to the present time. The discussion of the San José Scale in the newspapers, etc., has done a great deal of good, and anything that serves to emphasize the importance of clean stock is a benefit. The legislation of Nova Scotia will be very disastrous to the nurserymen of Ontario this year. It is claimed by the nurserymen that stock arriving in Nova Scotia after the journey, and being subjected to what would be a second fumigation there, would probably result in injury to the trees. As a test of the fumigation work in Ontario, I took heavily infested trees and placed them in various places in the fumigation building and apparently all the scale was killed. I hope that, if we get the expected grant, we may have enough men and inspectors to inspect the various nurseries thoroughly.

Mr. Gibson: Are the houses tight?

Mr. Caesar: This is being looked into. The whole question will be thoroughly investigated.

RECENT WORK ON THE APPLE MAGGOT IN ONTARIO.

William A. Ross, Division of Entomology, Ottawa.

This past season I devoted most of my time to an economic study of the Apple Maggot in Eastern Ontario. In this investigation I had a very capable and helpful co-worker in Mr. Chas. Good, a Guelph student, who acted under the instructions of Mr. Lawson Caesar, Provincial Entomologist. I am sorry I cannot eulogize my other co-worker, the weather man. He served chiefly to try my patience by substituting rain water for liquid baits, by drowning larvae, and by making everything wet and unpleasant.

I have now the pleasure of presenting to you a report of the investigation.

Emergence of Adults, Etc. In the Bowmanville orchard in which we did most of our work, adults were in evidence from the first week of July to mid-September. (The period of emergence in our rearing boxes extended from July 6th to August 20th). However, no egg laying was noticed until the third week in July.

Some entomologists have an idea that flies, developed from maggots which infested early apples during the previous season, leave the soil before those developed from late fruit larvae. However, this is merely a supposition and not a fact. According to our daily record of emergence, adults bred from fall varieties actually commenced to leave the soil before those bred from early Harvest apples.

Adults in Confinement. Our attempts to study the habits of adults in confinement met with every indifferent success. Two cages made of fly screen were hung on trees and each was so arranged that a branch bearing apples was inside it. We also constructed from the ground up a cage big enough to enclose a large branch well laden with fruit. Adults were confined in these cages. However, in place of observing these flies at work, we spent most of our time replacing their dead bodies with other adults—all, with the exception of two females, refused to live longer than four or five days in confinement. One of the exceptions completed her third week and the other lived four weeks. When fourteen days old the latter was found in copula with a sexually mature male which we had introduced into her cage. Two days after this she tried to oviposit; however, on this occasion and on all later occasions her attempts were ineffectual. She would extrude her ovipositor, raise herself and go through ovipositing motions, but she seemed to be too sluggish and lazy to pierce a passage through the cuticle, the tip of her ovipositor would merely slide up and down the surface of the apple.

I cannot understand why these confined flies did not respond in a more satisfactory way to our care. They were not cramped for room (especially in the large cage). They were provided with nourishment and moisture and lived under conditions as natural as possible.

Incubation of Egg. In ascertaining the duration of incubation of the egg, we marked newly made egg punctures, then four, five and more days after marking them we opened the punctures and examined the eggs. The average period required for incubation was six days, the minimum, four and three quarter days; the maximum nine days.

The fact that the rate of growth of the larvae keeps pace with the maturing of the fruit was noted by us, but as this interesting feature of larval development has been commented on so frequently, I shall not dwell on it.

Mortality of Eggs. The mortality of eggs is considerable. During the latter part of August after the major portion of the egg laying was done, we examined a large number of egg punctures for hatched, healthy and dead eggs. The average per cent. of dead eggs (infertile and diseased) in the September Sweet (autumn variety) was 17.4 per cent.; in the Snow (early winter variety) 34.9 per cent.; and in the Northern Spy, 17.1 per cent.

Mortality of Eggs and Larvae. The mortality of both eggs and larvae was very high in all varieties, as the following table will testify:

Variety.	Time of Maturing.	Per Cent. of Mortality of Eggs and Larvae.
Harvest	Summer	77 per cent.
September Sweet	Autumn	88 per cent.
Snow	Early Winter	97 per cent.
Spy	Late Winter	98.7 per cent.

Baits and Repellants. Adults before and during the egg laying period readily lapped up fruit juices and sweetened liquids. We served a varied diet of apple juice, diluted syrup, cut bananas and water to the flies in the cages. In our investigation of remedial measures we made use of this knowledge of the insect's feeding habits. Poisoned molasses was spread on several branches, other branches on other trees were treated in a similar way with Tanglefoot. Each Tanglefoot trap was sprayed with a different sweet smelling, attractive liquid. The essence of pear, peach and banana and citronella oil were used. Tin pans containing poisoned cider, essence of pear, citronella oil, and kerosene were also suspended on the branches of badly infested trees. However, the only bait which gave us any results was the kerosene. In seven pans of kerosene we secured at different times twenty males and eight females.

With the object of repelling egg laying females, nine tin pans containing crude petroleum were hung on a Tolman Sweet. But instead of repelling, the petroleum (or rather rain water with a scum of petroleum) attracted, as vouched for by dead flies in the tins.

Spraying. We tested two spray mixtures, one composed of arsenate of lead, glycerine and molasses and the other of paris green, glycerine and molasses, but neither yielded satisfactory results. We did not notice any adults feeding on the spray material. If any of them did, not enough died to make the spraying worth the cost.

Cultural Methods of Control. It does not seem to be possible to prevent the escape of flies from the soil by burying the pupae at a considerable depth with the plough, or by covering them with a baked crust of clay, or with a thick turf. One hundred pupae were placed at a depth of six to seven inches, and another hundred at twelve inches. Forty-one of the former and nineteen of the latter emerged.

Two plots of stiff clay, in each of which one hundred pupae had been buried at a depth of two inches, were watered and then rolled. The sun, as you can imagine, baked the top crust and made it appear as impervious as a flagstone. However, forty adults out of the possible two hundred managed to penetrate through the hard clay.

In a grass plot, sod was turned and one hundred pupae were placed beneath the thick turf. Twenty-eight adults came to the surface in this experiment.

The results obtained from these experiments will demonstrate to you the uncanny power these small, fragile looking creatures possess of working their way up to the surface.

Shallow cultivation, as a remedial measure, was given a trial. Two plots infested with pupae were worked frequently with a hoe and rake to a depth of two inches. From one plot sixty-five adults and from the other thirty-one appeared.

Exposure of Pupae. Pupae exposed to frost and other weather agents stand a very poor chance of becoming adults. Only one male developed from two hundred pupae which were exposed over the winter and spring.

Soil Fumigants, Etc. Interesting results were derived from our work on the destruction of pupae with soil fumigants and other chemicals.

Plots containing pupae (one hundred in each) were treated with Apterite, Vaporite and Cliff's Manurial Insecticide and these fumigants were worked into the soil. Similar plots were soaked with brine, lime sulphur, pyrethrum (in suspension), kerosene emulsion and copper sulphate. The following table shows the results:—

Chemical.	Date of first Emergency.	No. Adults.	No. Adults in Duplicate.
Apterite	July 11	15	1
Vaporite	" 25	5	2
Cliff's Manurial Insecticide	" 28	3	3
Brine (2 lbs. to 1 gal.)	" 12	36	27
Lime Sulphur (1.03)	" 13	44	33
Pyrethrum (1 lb. to 20 gals.)	" 14	47	23
Kerosene Emulsion (Double Normal)	" 17	11	5
Copper Sulphate (1 lb. to 5 gals.)	" 12	44	38
Check	" 9	58	.....
Duplicate Check	" 8	48	.....

Destruction of Fallen Fruit. Some day we may discover a satisfactory spray mixture or a perfect soil fumigant, but until that day we shall have to rely chiefly on the old remedial measure of destroying fallen fruit.

According to the data, which we have collected during the last two years, on the emergence of maggots from fallen fruit, an orchard can be freed from Apple Maggot by picking up summer apples every other day, autumn and early winter varieties every second week and winter varieties every third week.

I have with me a table which points out in a very marked way the influence which the cold and backward weather of the past summer had on the emergence of maggots:

EMERGENCE OF MAGGOTS FROM FRUIT.

Variety.	Time of Maturity.	Dropped.	Emergence.	Interval Elapsed.
1911				1911
Harvest	Summer	July 31	Aug. 3	3 days
Early Strawberry Seeding.	"	Aug. 4	Aug. 12	8 days
September Sweet	Autumn	Aug. 8	Aug. 23	15 days
Snow	Early Winter	Sept. 15	Oct. 7	21 days
Spy	Winter	Sept. 22	Oct. 23	31 days
1912				1912
Harvest	Summer	Aug. 15	Aug. 29	14 days
Early Strawberry Seeding.	"	Aug. 17	Sept. 3	16 days
September Sweet	Autumn	Aug. 24	Sept. 12	19 days
Snow	Early Winter	Aug. 27	Sept. 16	20 days
Spy	Winter	Sept. 13	Nov. 15	62 days

If you care to look at this table you will notice in the case of harvest apples that the number of days which elapsed between the dropping of the fruit and the coming out of the larvae, was four times as long this season as it was during the summer of 1911.

CHICKENS AND CULTIVATION. In endeavouring to prove that chickens will do valuable work in controlling this pest in small orchards, we covered two plots (each with one hundred pupae) with two extra large rearing boxes. We confined two hens in each box, and left them in over two weeks. The plots were kept cultivated. The chickens did not receive an over-liberal supply of food and were thus forced to scratch amongst the loose soil for a living. Their quest for food must have met with some success because no flies appeared in either box.

During the fall of 1911, 165 pupae were placed within a marked portion of a chicken run. This piece of ground must have been worked over pretty thoroughly by the hungry poultry, because only two adults escaped from it this summer.

NATURAL HOSTS. Regarding the natural hosts of the Apple Maggot I have little to say. Mr. Good and myself found it at work on a seedling crab-apple which was in close proximity to a badly affected orchard. We examined a large number of hawthorns in Durham and Hastings Counties, but discovered no trace of the insect on them. However, Mr. Swaine was kind enough to send us infested haws which were collected in the neighborhood of St. Anne's, Que., and we secured larvae and pupae from them.

VARIETIES ATTACKED. I have listed over thirty varieties of apples, which I have found attacked by the Apple Maggot in 1912, and I am strongly inclined to think that no variety is exempt. Harvests, Sweets (September, Tolman, etc.), Snows, and Spies are probably the most seriously affected varieties in Ontario. Acid apples such as Astrachan and Duchess are much less subject to injury than sub-acid and sweet varieties.

VARIETIES ATTACKED AND DEGREE OF INFESTATION.

Degrees: Very high.....1 High.....2
Medium.....3 Low.....4
Very low.....5

Variety	Degree of Infestation	Remarks, etc.
Alexander	4	Sometimes badly attacked.
Astrachan	4	
Baldwin	5	
Bellefleur	3	
Ben Davis	3	
Crab-apple	2	Only one variety and this early ripening.
Culvert	3	
Duchess	5	According to F. Dempsey—2.
Gravenstein	2	
Greening	3	
Holland Pippin	4	
Hopkins Seedling (Red Astrachan in character)	4	
Hurlburt	4	
Jennetting	3	
Johnson's Seedling	2	
King	5	
Maiden Blush	4	
Mann	5	
Pewaukee	4	
Russet	4	
St. Lawrence	3	
September Sweet	1	
Snows	2	Sometimes very bad.
Spy	2	
Stark	4	
Strawberry Seedling (Red sweet apple)	1	Mrs. Belman, Bowmanville. Meadows, Port Hope.
Tolman Sweet	1	
Wagners	3	
Wealthy	3	
Yellow Harvest	1	
Yellow Transparent	4	

COMMENTS. In some orchards certain varieties may be exempt from attack, whereas in others these same varieties may be badly infested. In an orchard near Bowmanville none of the Ben Davis were punctured; on the other hand, in a place near Port Hope and another near Stirling this variety was badly attacked.

In affected orchards seedling trees are practically always badly infested.

DISTRIBUTION. Chiefly through the courtesy of Mr. Caesar I have records of the occurrence of this pest in the following counties of Ontario:—Prince Edward, Hastings, Frontenac, Northumberland, Durham, Ontario, Wentworth, Lincoln, Welland, Norfolk, and Carlton.

I should be very grateful if any member of this Society would add to this list.

MR. GIBSON: Some years ago I carried on some breeding experiments. The depth to which the larvæ burrow in confinement is of much interest. In one jar I had put about eight inches of earth, and some of the larvæ burrowed to the bottom of the jar, where they pupated.

MR. ROSS: I had twelve inches of earth and ninety per cent. emerged.

DR. HEWITT: What was the usual depth?

MR. ROSS: Possibly about three-quarters of an inch. Most of them.

Dr. Hewitt: I think Mr. O'Kane of New Hampshire found that the average depth of pupation was one and a half to two inches. It is an important point to decide at what depth the larvæ usually pupate in connection with any system of cultivation as a means of control. The insect I am most familiar with, namely the house-fly, can emerge in sand from a depth of five to six feet, and I have no doubt that the Apple Maggot can emerge from a greater depth than eight inches in a light soil; a great deal depends on the character of the soil.

Mr. Ross: These larvæ had bored in sandy soil. The larvæ of course pupated differently. Under fallen fruit and in the fallen fruit itself, especially in the case of crab-apples. Of course the percentage of mortality of pupæ is very high.

Dr. Hewitt: Have any pupated in merchantable fruit?

Mr. Ross: No.

Mr. Swaine: How is the fruit destroyed? Is it sufficient to cover it with lime and earth.

Mr. Ross: I did bury some with lime, and twenty per cent. came through.

Mr. Swaine: I know of a certain Mr. Shepherd, who boiled the infested fruit and fed it to stock.

Mr. Ross: I must mention that in the evaporators there are quantities of infested fruit used.

INSECTS OF QUEBEC FOR THE YEAR 1912.

C. E. Petch, Division of Entomology, Ottawa.

Not arriving until the latter part of July at the Field Laboratory, Covey Hill, Quebec, my report will be somewhat faulty.

The Tent-caterpillars were very bad this year; many unsprayed orchards were entirely defoliated. From observations, I believe that the Forest Tent (*Malacosoma disstria*) is worse than the Apple Tent (*Malacosoma americana*). Some Hymenopterous parasites were reared from the pupæ of the Apple-tent. Some twenty bee-hives were entirely destroyed by bee-moths. Both the Larger Wax-Moth

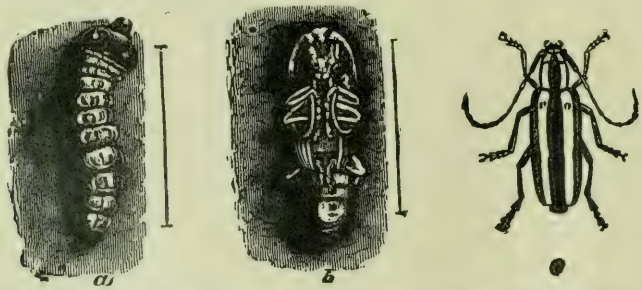

Fig. 18.—Round-headed Apple Tree Borer (*Saperda candida*): *a*, larva; *b*, pupa; *c*, adult.

(*Galleria mellonella*) and the lesser Wax-Moth (*Achroia grisella*) having been present. Several plum and birch trees were badly infested with Terrapin Scale (*Eulecanium nigrofasciatum*). Oyster Shell Scale (*Lepidosaphes ulmi*) was very plentiful. Large numbers of the scales were found on the fruit of the apple and the plum, causing it to be greatly mis-shapen in many cases,

especially Duchess apples. The Green Aphis (*Aphis pomi*) was very plentiful, especially on nursery stock, and suckers. Some of the people sprayed with arsenicals to control it. It caused discoloration of Yellow Transparents by little red spots forming. The leaves of some maple trees were falling about the middle of August because of aphis injury. Buffalo Tree Hoppers, Snowy Tree Crickets, Blister Beetles, and Flea-beetles were fairly common. The foliage on a few plum trees was very badly distorted by numerous finger-like galls caused by *Eriophyes sp*.

The bees in this district were found to be suffering very badly from European Foul brood (*Bacillus alvei*). Grasshoppers and Potato Beetles were not very plentiful. The Apple Leaf Miner (*Tischeria malifoliella*) was extremely prevalent in some orchards. Grape vines and Virginia creeper were very badly attacked by leaf-hoppers (*Typhlocyba comes*). They lost the greater portion of their foliage very early owing to these insects. Both apple-tree borers (*Saperda candida* and *Chrysobothris femorata*) were present in considerable numbers. Stink Bugs (*Pentatomidae*) were common and the Tarnished Plant Bug (*Lygus pratensis*) appeared in large numbers, especially in the hoed crops, late in the season.

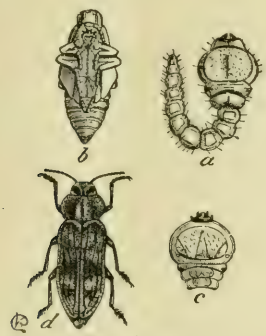

Fig. 19.—Flat-headed Apple Tree Borer (*Chrysobothris femorata*): *a*, larva; *b*, pupa; *d*, adult.

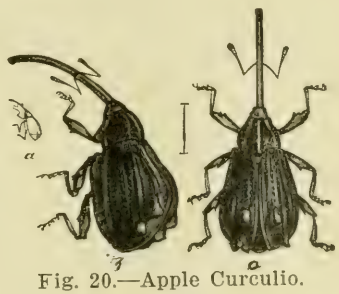

Fig. 20.—Apple Curculio.

The four most important insects in this district were the Apple Maggot, or Railroad Worm (*Rhagoletis pomonella*), Codling Moth (*Carpocapsa pomonella*), Plum Curculio (*Conotrachelus nenuphar*) and the Apple Curculio (*Anthonomus quadrigibbus*), and they rank in that order as to injury.

The Apple Maggot was most injurious on Tolman's Sweet, Alexander, and Lowland Raspberry. Mr. R. W. Sheppard, Como, P.Q., reports severe injury due to this insect. Mr. Ross has worked especially on this insect and I leave him to describe it in detail. The Codling Moth was plentiful, and it has received Mr. Caesar's careful attention, I leave any questions about it for him to answer. The most injurious insects are the curculios. In some cases this year the fruit could not be sold, because it was so badly disorted. Plums, apples, and pears were badly affected. The plum curculio was the more injurious one on Duchess.

The Apple Curculio *Anthonomus quadrigibbus*, however, is the more important of the two in this distict, and is the most injurious insect in the vicinity of Covey Hill. So far as I could find out, it has received very little attention, and is reported in books and bulletins as "sometimes injurious." However, in this district it is deserving of a thorough investigation. It was reported by Mr. N. E. Jack, Chateauguay Basin, P.Q., as very injurious to early apples.

It can be easily distinguished from the Plum Curculio by its snout, which is as long as the rest of its body, and is carried straight in front. It has, also, four humps on the sloping portion of its elytra. It is light-reddish-brown to dark-reddish-brown in color, and is about one-quarter inch to one-third inch long. It does injury by egg-laying and feeding. I am not able to state at what stage in the growth of an apple the eggs are laid, but the result of an egg-puncture is a hard green core, which penetrates, generally, nearly to the centre of the apple. These green cores spoil the fruit for either eating or cooking purposes, because they remain as hard lumps even after cooking. Egg-punctures, also, cause the apples to become distorted. They started to feed on the fruit the first week in August this year and were found as late as September 3rd. They started to feed first on the early varieties. They entered the soil first on August 29th. However, had the weather not been so cold just then, I would have expected them to feed until a much later date. Sanderson says: "They feed very little before they enter the soil for the winter." I do not agree, because as many as forty to sixty feeding punctures on one apple were common.

Life History. The number of eggs to hatch was a little over 28 per cent. The number of eggs per apple varied from one to many. One specimen of Tolman's Sweet had twenty. The larvæ are white or yellowish-white, about one-half inch long when full grown, footless, and possess an enlargement of the anterior abdominal segments, which prevents them from straightening out. They eat large irregular tunnels in the fruit. The change into the pupal stage takes place within the fruit. The pupal stage was found to be between five and six days. The adults emerge from the fruit and then begin to feed. They pass the winter in the soil, but I cannot say whether the nature of the soil would have any influence on the depth, nor do I know the depth at which they winter. In many cases they do not leave the fruit before it is picked; therefore, they could easily be spread in the larval or pupal condition in the shipment of the fruit.

Whether they would survive the winter or not in barrels is a question which remains to be answered. The adults are most commonly seen on the fruit the second and third weeks in August. They hold tenaciously to the fruit. They feed on either end and sometimes on the cheek. In only one case was more than one Curculio found on a single apple and in this case there were two, one on each end. When disturbed they remain very quiet, and in many instances feign death. They do not fly readily, and are slow in their movements. They are not attracted by lights placed in the trees at night. Ten bands of Tanglefoot were placed on the trunks of trees, but only two specimens were captured. Many attempts were made to attract them to poisoned honey, kerosene, molasses, tanglefoot and essence of pear, but without results. Where trees were sprayed with either lime-sulphur or Bordeaux mixture, the injury was greatly lessened. These substances probably act as repellents. Heavy rains did not interrupt these insects from feeding. Haws and wild crabs are given as their natural hosts and as causes of their prevalence. However, in this orchard where they were so numerous there was only one Haw tree, while the seedling crabs were not seriously injured by them. The only cultivated, pruned and properly sprayed orchard in the district was entirely free from its injury, while two years ago the injury was very serious and last year to a considerable extent. From this it would appear that a man could keep his orchard free from this insect regardless of the actions of his neighbors, and, also that by the above methods the past can be completely controlled.

The varieties worst injured by egg punctures were Tolman's Sweet, Greening, Golden Russet, Ben Davis, Alexander, and Duchess. The worst injured by feeding were Tolman's Sweet and Alexander. They were extremely injurious to Bartlett Pears.

I have nothing to offer in the way of remedies, because I have not performed any experiments as yet in cultivation or spraying. Jarring is offered by Sanderson as a remedy. How effective this may be on young trees, I cannot say, but to shake them from old trees would result in a large loss of fruit because they hold to it so firmly.

My reasons for dealing at such length on this insect are: first, it has not received any careful investigation; and, secondly, it is the most injurious insect on apples and pears in this portion of Quebec.

INSECTS OF THE SEASON IN ONTARIO.

L. Caesar, B.A., B.S.A., Guelph.

With a few exceptions this season has been comparatively free from any serious insect injuries, several of our worst pests being much less destructive than usual.

Orchard Insects.

Codling Moth (*Carpocapsa pomonella*). This insect has not been so abundant as usual, probably because the wet, cold season retarded development and so lessened the percentage of the second brood. Each year very gratifying progress is being made in the number of fruit growers who are meeting with excellent success in controlling the Codling Moths by thorough spraying. It is worth noting that only those who spray very thoroughly, so that the trees having much bloom are literally drenched, are getting really satisfactory results. This sort of spraying is also giving us apples free from scab and no injurious results are reported from it. I do not recommend so heavy spraying for any later applications that may be given.

Lesser Apple Worm (*Enarmonia prunivora*). This caterpillar which so closely resembles the codling moth larva is found in abundance almost every year in haws. It is apparently not very destructive to apples in the Province. I have found it attacking apples at Guelph and in the Niagara District. This year infested apples were sent in from Prince Edward County on July 7 which contained larvæ almost full grown. Both of these had entered by the calyx end and were feeding a short distance below the inner cavity. I mention this as indicating that these larvæ evidently mature about as early as the earliest Codling Moth larvæ. There is, of course, a second brood. I also found the larva in sour cherries this year at St. Catharines.

Plum Curculio (*Conotrachelus nenuphar*). As usual, much damage was done by this beetle to cherries, plums, peaches, apples, and pears. I did not, however, see so many evidences of its fall work on apples as usual; whether this was due to the wet weather I cannot say. Apricots, wherever grown in the Niagara District, seem to be particularly attractive to the Curculio.

Apple Curculio (*Anthonomus quadrigibbus*). Last year I found many of this species feeding upon haws at Grimsby, but none on apples. This year I took a single specimen on apple in June about ten miles from Winona (Niagara District). I believe Mr. Swaine found it fairly common near Montreal a year or two ago.

Bud Moth (*Tmetocera ocellana*). Many complaints have been made of the damage done by the larvæ to buds. I have seen them quite abundant occasionally, but, with the exception of young trees not yet bearing fruit, I cannot say they have been so destructive as many growers claim. So far as I can judge, well sprayed orchards are seldom much troubled. Apparently the early part of this season was unfavorable to the larvæ and many died, but in spite of this, there was an average number of infested leaves this autumn showing evidence that sufficient had been left to produce a normal number next spring.

Case-Bearers (*Coleophora fletcherella* and *C. malivorella*) were not so numerous as usual.

Fig. 21.—Orchard defoliated by Fall Canker-worms.
(Photo taken about June 12th.)

Palmer Worm (*Ypsolophus pomotellus*) which was very abundant in many orchards in Western Ontario last year was greatly reduced in number this year, though a few could be found in almost any district.

American Tent Caterpillar (*Malacosoma americana*). In the western half of Ontario this species has been increasing in number but is not yet at all abundant. east of Toronto, however, it has been a scourge this year, especially from about Brighton eastward, getting worse the farther east one went. Unsprayed orchards were badly defoliated, but it is a pleasure to report that in every case where orchards received the application with lime-sulphur before the buds burst and lime-sulphur with arsenate of lead just before the blossoms began to burst, there was scarcely a nest to be found. A number of the sprayers reported that they

felt sure the strong lime-sulphur alone of the first application had killed most of the larvæ.

Fall Canker-Worm (*Alsophila pometaria*). This old foe of orchards and other deciduous trees was much more abundant and destructive this year than I had ever seen it before, but as usual it was confined to a few localities. At Dundas and near Stoney Creek several orchards lost almost all their foliage through its attacks. From two or three other districts similar reports of injury were sent in. This photograph was taken by Mr. Baker and me in an orchard near Stony Creek and shows the sort of work done by this pest. Fortunately, one of our fourth

Fig. 22.—Cluster of small, woody, deformed Apples, caused by the feeding of aphids in the twigs and fruit.

year students had rented a badly infested orchard in the district. He sprayed this very thoroughly shortly before the blossoms burst and succeeded in getting such excellent results that not enough caterpillars escaped to do any appreciable damage. The worst orchards I saw were in sod. From caterpillars brought to Guelph by Mr. Baker numerous females and a few males are now, Oct. 11, emerging.

Aphids. This has been one of the worst seasons we have had for Aphids, the wet spring giving them an excellent start. On bearing apple trees by far the most destructive species in the Niagara District was the Rosy Aphis (*Aphis sorbi.*)

In many orchards the ravages of this pest caused such a large number of the leaves on the lower branches to turn sickly and yellow, that the trees looked very unsightly until these fell off. Much of the fruit was deformed and hung in clusters of dwarfed apples.

Aphis avenae seemed to be the next most common species and was very destructive to nursery stock and young orchards in August and September. I identified these two species, but was not sure whether *Aphis pomi* was present or not. I think that if it was, it must have been in small numbers. About the first week in July both *Aphis sorbi* and *A. avenae* disappeared from apple trees.

The Black Aphis of the Cherry (*Myzus cerasi*) also disappeared at this time, but I could not be sure whether this was due to migration or the attack of Ladybird beetles and other predaceous insects. It had been somewhat more abundant than usual.

The Currant Aphis (*Myzus ribis*) was also every abundant and did much damage. About fifty per cent. of this species were parasitized by one or more hymenopterous parasites. The adults of these could easily be seen and were quite numerous. There was no evidence of any parasitic work on *Aphis sorbi* or *A. avenae*, although predaceous insects, especially Ladybird beetles and their larvæ, were very helpful. I saw no signs of any fungous disease attacking any species.

In the early part of June there was a moderate number of Peach Aphids (*Myzus persicae*) present, but they did very little damage and soon disappeared.

The Woolly Aphis (*Schizoneura lanigera*) could be found in almost every orchard but not in unusual numbers.

Mr. Baker and I planned some experiments on the control of Aphids early in the season, when the buds were just ready to burst. At that date we applied Black Leaf 40 along with the regular spring strength of lime-sulphur to two badly infested trees. Examination of these trees a day or two later showed that almost every Aphid had been killed. On check trees they were still alive. Further tests with other mixtures were made, but we have not yet found anything so good as the above. There is need, however, of a cheaper remedy than Black Leaf 40. I have very little faith in lime-sulphur as a remedy for aphids of the orchard.

San José Scale (*Aspidiotus perniciosus*). Every year or two we hear of some new district into which this scale has gone. This year Mr. McNeil of Ottawa wrote to me that it was reported to be in an orchard near Woodstock. I went up to investigate and found about a dozen trees nearly killed by it and all the rest of the orchard infested. Clearly it had been in the orchard for about four years without any one knowing what it was. Mr. Kydd of the Fruit Branch, Toronto, and I held a demonstration meeting in this orchard in October. Arrangements have been made to have the orchard sprayed and looked after by the Department as one of its regular demonstration orchards. This seemed the wisest course to pursue, so that an example of thorough work might be set. Two neighboring orchards are just becoming infested, but no injury has been done to either yet. Though the scale is spreading, the use of lime-sulphur and thorough spraying is spreading still more rapidly. In Essex, one of the worst scale districts, the Representative wrote to me a few days ago that more spraying was done last year than in all the years before taken together. It occurred to me that the severity of last winter might show a much diminished number of scales this year, but apparently it had little effect.

Blister Mite (*Eriophyes pyri*). In a large number of unsprayed orchards this mite is doing much to prevent average crops of apples. I sprayed a very badly infested orchard this spring to test the comparative effect of spraying before the buds had begun to burst and when they were bursting. April 25 and May 6 were the respective dates. Both gave excellent results; better than I had even hoped for.

Brown Mite (*Bryobia pratensis*) or Red Spider (*Tetranychus bimaculatus*). In the Niagara District the foliage on many plum trees—whole orchards in fact—had a dull grayish color, indicating clearly that something was wrong. On examination towards the end of August it was quite evident that some mite, probably the Brown Mite, from the way the eggs were found all over the leaves and along

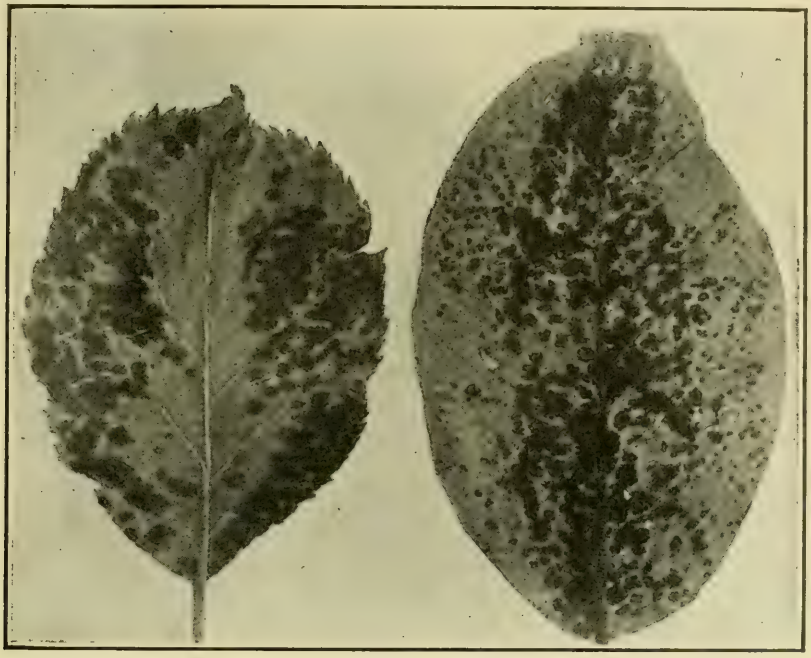

Fig. 23.—Blister Mite work on apple and pear leaves.

the midrib on the upper surface, and also from the absence of any silken web on the under surface, had caused this appearance. Unfortunately the mites had almost all disappeared. A few Red Spiders were seen, but I doubt whether these were the offenders. It is probable that the reason that lime-sulphur sprayed plum trees in the neighborhood had healthier foliage than Bordeaux sprayed ones was due to the efficiency of lime-sulphur against mites.

Injury by Red Spiders to Currant leaves in the Niagara District was very noticeable.

Pear Psylla (*Psylla pyricola*). Early in the spring a good many psyllas were seen, but with the coming of the wet, cold weather they soon disappeared, and I saw none again until July 12, when a few nymphs were observed. They did not become numerous enough anywhere, I think, to do any appreciable damage.

Cherry Fruit Flies (*Rhagoletis cingulata and Rhagoletis fausta*). These two flies were about equally common, and did more damage to Montmorency

cherries than the Plum Curculio. In some orchards it was difficult to find one cherry out of five that did not contain a maggot. A few experiments on control measures were tried, but there was not time to do the work thoroughly. I am expecting to study these pests more carefully next year.

Apple Maggot (*Rhagoletis pomenella*). As Mr. Ross is giving an address on the joint work being done on this insect by the Ottawa Department of Entomology

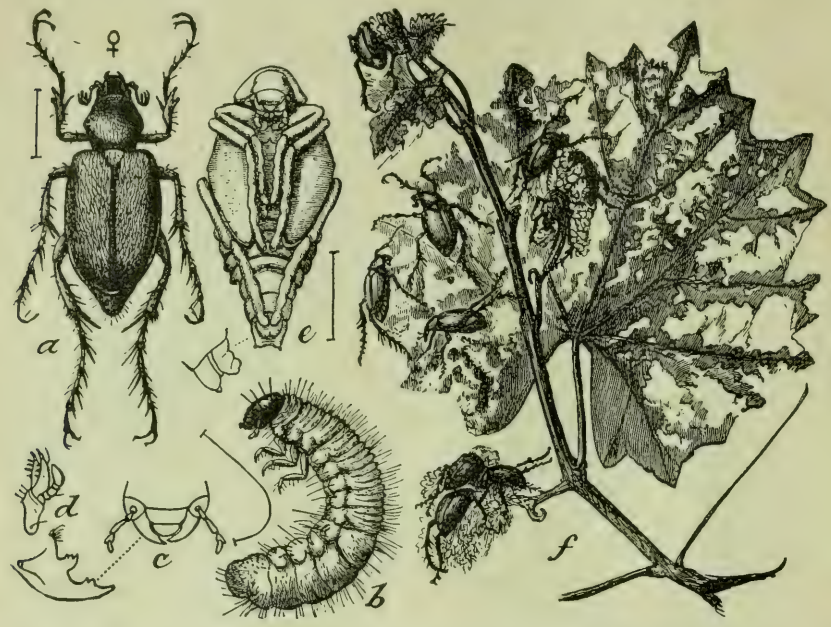

Fig. 24.—Rose Chafer (*Macrodactylus subspinosus*): *a*, beetle; *b*, larva; *c* and *d*, mouth parts of same; *e*, pupa; *f*, injury to leaves and blossoms with beetles, natural size, at work. (After Marlatt, U. S. Dept. Agriculture.)

and our Department, I shall not make any further remarks on it than merely to say that I hope that next year may be more favorable for the study of this insect than this has been, and that if so, we may be able to finish the investigation in Ontario unless some new phase of the subject presents itself to us.

Rose Chafer (*Macrodactylus subspinosus*). In most districts the Rose Chafer did much less damage than usual, but in one or two cases it appeared in new districts and did considerable damage to grapes, raspberries, and young cherry

Fig. 25.—Pear and Cherry Slug.

trees. A district thus attacked was composed of a few orchards between Beamsville and Lake Ontario. In one of the orchards arsenate of lead—four pounds to forty gallons—sweetened with about a gallon of molasses was sprayed on the trees and vines. The owner did not know whether it had done any good or whether the

beetles had largely disappeared of their own accord. As I was interested, I visited the orchard and examined the ground around the trunks of several small sprayed cherry trees and in each case found dead beetles. It looked to me very much as though the spray had been at least fairly effective.

Pear and Cherry Slug (*Eriocampoides limacina*). Though not quite so conspicuous as usual, the work of this pest was easily visible in almost every district. Young cherry trees were usually worst attacked: pears suffered but little.

Grapes and Bush Fruits Insects.

Grapevine Leaf-hopper (*Typhlocyba comes*). This leaf-hopper was present in most vineyards but was not so destructive as last year.

Currant Stem-girdler (*Janus integer*). Two years ago I reared this saw-fly from currant twigs sent me from Lambton County. In June of this year I found its fresh work at Fruitland. A considerable number of currant twigs had been

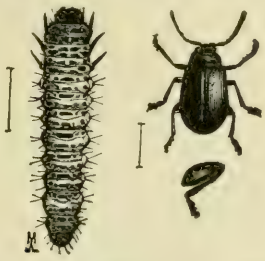

Fig. 26.—Grape-vine Flea-beetle and larva, much enlarged; also leg, greatly magnified.

girdled but not a sufficient number to cause any alarm. The owner of the plantation had never seen the injury before and was anxious to discover the cause.

Imported Currant Borer (*Aegeria tipuliformis*). In almost every currant plantation a very large number of canes are attacked by this insect

The Grapevine Flea-beetle (*Haltica chalyybea*). Several vineyards in the Niagara District were somewhat severely attacked by these beetles. The larvæ could be easily found on wild grape leaves in June.

Raspberry Root-borer (*Bembecia marginata*). Old raspberry plantations in the Niagara District are very badly infested by this borer.

Fig. 27.—Grape-vine Flea-beetle, showing beetles and larvæ at work.

Blackberry Leaf-miner (*Metallus rubi*). This leaf-miner is still abundant in parts of the Niagara District. Fortunately it does almost no damage until about the middle of July. By this time the forming fruit is getting well advanced. Control seems difficult. Kerosene emulsion has been recommended, but in my tests it proved useless, as it could not penetrate even the dead epidermis. The insect passes the winter in the ground in the larval stage in a small, round, earthen case abut 5 m.m. in diameter. Possibly removing the earth to a depth of about two inches from underneath the bushes in spring, followed by frequent cultivation, might destroy the larvæ or pupæ. The cases, however, do not break very easily.

Raspberry Cane-borer (*Oberea bimaculata*). Dr. Bethune received several letters containing specimens of this insect's work but not so many as in previous years. I saw almost no sign of its presence in the Niagara District.

Strawberry Weevil (*Anthonomus signatus*). Specimens of this tiny weevil were sent in from Brant County, where it was doing sufficient injury to attract the attention of some growers. It occurred in small numbers in one or two other localities.

Insects Attacking Vegetables.

Cutworms. Very few outbreaks of Cutworms have been reported. At Burlington there was considerable damage done to cabbage and other closely allied plants by what I believe was the Red-backed Cutworm, but this is the only case I can recall of anything like an outbreak this year.

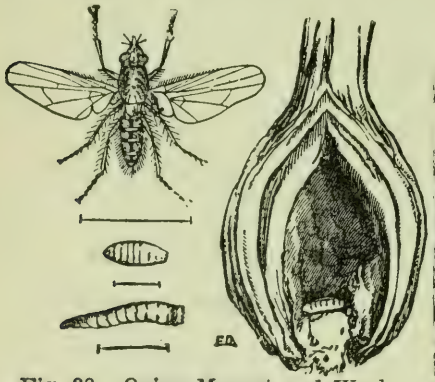

Fig. 28.—Onion Maggot and Work.

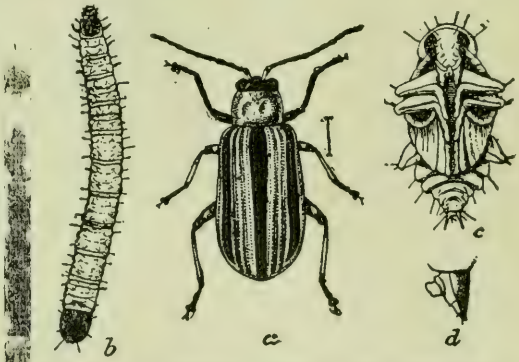

Fig. 29.—Cucumber Beetle, larva and pupa.

Onion and Cabbage Maggot (*Pegomyia brassicae* and *P. cepetorum.*) These insects were not so abundant as last year.

Cucumber Beetle (*Diabrotica vittata*). Comparatively few of these beetles were to be seen in most places visited.

Asparagus Beetles (*Crioceris asparagi* and *C. 12-punctata*). These two beetles were moderately abundant at Guelph, but very few complaints came in about them. (Fig. 30.)

Colorado Potato Beetle (*Leptinotarsa decemlineata*). It is a pleasure to be able to report that Perillus bioculatus var. claudus seems to have passed the winter safely in most districts and to have done much to control the Potato Beetle. This friend is quite common at Guelph and in many other parts of Western Ontario. I have had it reported from as far east as about eight miles from Ottawa. I sent a few live specimens to the latter district where this year the insects were found. The specimens had been freed in the potato field.

Insects Attacking Cereals and Grasses.

White Grubs and Wireworms. Many complaints were received of injury to grain crops and potatoes by these larvæ, especially from Western Ontario.

Hessian Fly (*Mayetiola destructor*). The Hessian Fly has in many districts been unusually destructive. As soon as I saw that some wheat fields had as many as fifty per cent. of the plants destroyed, I sent out a circular letter outlining the most up-to-date methods of control. As the wet weather prevented almost any early sowing, it will be interesting to see the result next year. Many parasites were found to be present, but whether they would be in sufficient number to control the flies next year unaided is very doubtful. They are easier to rear than the Hessian Fly and are apparently present in considerable numbers almost every year.

Grasshoppers. In spite of the wet season grasshoppers were very destructive in a few districts, and especially in parts of Norfolk County.

Rare or Uncommon Insects.

Alabama argillacea. Large numbers of this moth were seen around electric lights at Woodstock on Oct. 11. Specimens were sent to me by Mr. James Dunlop

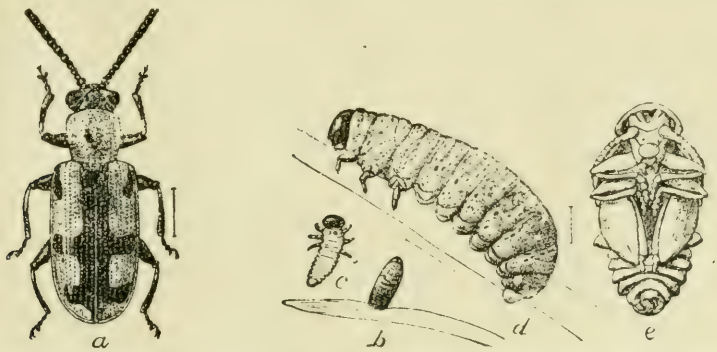

Fig. 30.—Asparagus Beetle: *a*, adult; *b*, egg; *c*, young larva; *d*, full-grown larva; *e*, pupa.

of that town, who said that at some posts they could have been shovelled up like a swarm of bees. Last year it will be remembered we had also a visit from these Southern moths.

Typhoea fumata. This little brown beetle, belonging to the family Mycetophagidae, was sent to me by the "Farmer's Advocate" from a man who said that for two years it had been injuring the wheat in his granary and had caused it to heat. Whether it was the real cause of the heating I do not know, but believe it is worth while recording this beetle as a granary pest in the Province, since it is rarely, if ever, mentioned in any Canadian reports on granary insects.

Maple Leaf-roller (*Cenopis pettitana*). A correspondent at Kenmore, near Ottawa, sent me specimens of the larvæ which he said were injuring the foliage of his sugar maple woods greatly. I reared the adults and sent specimens to Mr. Gibson, Ottawa, who identified them as *Cenopis pettitana.* Mr. Baker and I also obtained larvæ from elm trees in the Niagara District. The adults from maple and elm looked to be the same and Mr. Gibson could see no difference.

Tortrix conflictana. Mr. Baker found this species in great abundance in Toronto. Mr. Gibson kindly identified it for him.

Mr. Gibson: I was interested in Mr. Caesar's remarks on the Cotton Moth. A few weeks ago I had a letter from Mr. Calvert, of the Normal School, London, Ont., enclosing two photographs of Cotton Moths which had been taken at London, with a report that the insect had been enormously abundant. The moth was noticed at Ottawa on October 15th, but only in small numbers. When in New York City, in the middle of last month, I saw a flight of this moth. Thousands of specimens were present in Broadway, flying into restaurants and other brightly lighted places, where they could obtain an entrance.

Dr. Hewitt: In reference to the Cotton Moth, I just received this morning a note from Dr. William Saunders, late Director of the Experimental Farms, who was one of the original founders of the Society, but who was unfortunately compelled to discontinue an active interest on account of increasing duties. He encloses a short interesting paper on the Cotton Moth, and he has asked me to communicate it to the Society. Further, he wishes to be kindly remembered to any members of the Society who may inquire of him. (Dr. W. Saunders' paper was then read by Dr. Hewitt.)

AN INVASION OF COTTON MOTHS.

Wm. Saunders, C.M.G., London. Ont.

On the night of Thursday, October 10th, 1912, there appeared about the electric lights at the station of the Canadian Pacific Railway in London, Ont., a great swarm of moths of the Cotton Leaf Caterpillar (*Alabama argillacea* Hbn.) About the electric lamps the air was laden with the moths, which were estimated by those who saw them at two inches or more in depth on the floors of the railway station. The following night, Friday, October 11, they appeared again in great numbers, when the enclosed photograph was taken, which, although showing them in decreased numbers, is convincing evidence of the formidable character of the invasion. (Photograph passed around at meeting.) I heard of the arrival of the insects on Friday night, when, on looking through the rooms of my house, we captured four specimens of the moth. As this was nearly half a mile from the railway station it shows that they had found their way into buildings for some distance from the main point of their occurrence.

I was not able to visit the scene of their great abundance until Saturday morning, when I found the sidewalks and the ground about the electric lights strewn thickly with the dead moths. It was not easy to make even an approximate estimate of their numbers, but under one of the electric lights where the moths had been very abundant I should not think that 10,000 or even 50,000 an excessive estimate.

I found living specimens in good condition hiding in sheltered spots about the windows and doors of the station; on one window I counted 24, all good specimens.

In a letter from my son, Dr. A. P. Saunders, written Oct. 11, 1912, from Hamilton College, Clinton, New York, he says:

"We had an invasion here in Clinton on Oct. 6th of the Cotton Moth (*Alabama argillacea*); they came just before dawn. The night watchman told me he could not see the electric light for the moths. When I got down town about noon

the following day there were from 10,000 to 100,000 under each one of the few arc lights in the village, and a good many under the little incandescent lights. Under each of the arc lights the moths formed a patch about 10 feet across, where they literally covered the ground. Thousands of them had been crushed by wagons, but there were also thousands and thousands of perfectly fresh specimens towards the edge of the road. All the electric light poles, the neighbouring trees, shop fronts, and indeed everywhere where there was light was well supplied with specimens. I took about a hundred as a memento of the occasion. These moths may have been brought up here by high winds in the upper air currents. The vast majority of the specimens that had not been crushed looked as fresh as if they had only been out a day, so that one cannot think of them as having worked their way up by slow degrees. They seem now to have disappeared, at least I have seen none since, except one that I unconsciously brought home on my coat, and which has since been about the house."

In London the moths were found in greatest abundance about the C. P. R. railway station.

INJURIOUS INSECTS OF QUEBEC IN 1912.

Prof. Wm. Lochhead, Macdonald College, Que.

The season of 1912 was quite abnormal in Quebec on account of the large rainfall in May, June, August, and September. No doubt this excessive precipitation affected to some extent the insect life, but the exact relations are difficult to determine.

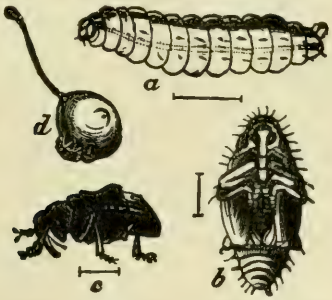

Fig. 31.—Plum Curculio: *a*, larva; *b*, pupa; *c*, beetle; *d*, young fruit attacked.

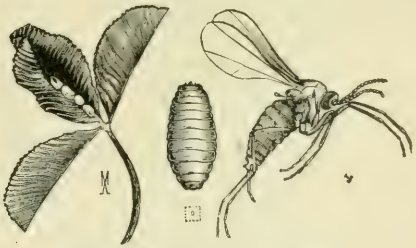

Fig. 32.—Clover-leaf Midge.

Tent Caterpillars. The most abundant insects of the season were the two common species of Tent Caterpillars (*Malocosoma americana* and *M. disstria*). They appeared in immense numbers in most districts of the province and caused much injury to orchard and fruit trees, *M. disstria* (Forest Tent Caterpillar) being the more abundant species. A disease, apparently bacterial, broke out among the caterpillars about June 11th and killed many, the mortality being greater among the caterpillars of *M. americana.*

An effort was made to determine the extent of parasitism present. Ichneumons were obtained from *M. disstria,* but not in sufficient numbers to cause any appreciable diminution in numbers.

In the insectary *M. americana* started pupating on June 8th, and *M. disstria* on the 21st. Adults of both species about July 5th.

Bud Moth. This small insect was very abundant on the Island of Montreal in May and June. In one instance more than 100 specimens were obtained from a small five-year-old apple tree. Pupation occurred about June 15th, and adults appeared on July 9th.

Buffalo Tree-hopper. This bug was quite abundant, and many apple branches were observed to be badly wounded. An interesting feature of the occurrence of the nymphs was their abundance on clover, so that the presence of clover fields must be taken into consideration in devising methods of control.

Plum Curculio (Fig. 31). This insect is not destructive at Macdonald College, though in near-by orchards there was evidence of considerable injury, especially to plums.

Oyster-shell Scale. This scale insect is perhaps the most abundant insect in Quebec orchards, and does a great amount of damage, especially in neglected orchards.

Fig. 33.—Spotted Asparagus Beetle.

Fig. 34.—Larva of Currant Saw-fly.

Apple Plant Louse. *Aphis mali* was abundant on the young trees, and caused considerable damage.

Clover-root Borer. The roots of old red clover plants in the sod of the plum orchard at Macdonald College were observed to contain many larvæ of the Clover-root Borer.

Clover-leaf Midge (Fig. 32). This insect was quite abundant on leaves of white clover at the College.

Striped Cucumber Beetle. This pest was destructive to squashes.

Asparagus Beetle. The 12 spotted species were abundant, but very few of the *asparagi* were observed.

Turnip Flea-beetle. This insect was abundant but did not appear until the plants had got a good start, so that the damage was inconsiderable.

Raspberry-cane Borer. Considerable wilting of canes occurred in July owing to punctures made by this insect.

Currant Saw-fly (Fig. 34.) Large numbers of the larvæ of this insect were observed on currant bushes during June and July. Pupation began about June 10th, and adults began to appear on the 22nd.

Currant Aphis. This plant louse was quite abundant, and caused considerable damage to the leaves.

NOTES ON SOME FOREST INSECTS OF 1912.

J. M. Swaine, Assistant Entomologist for Forest Insects, Ottawa.

During the season just closing there have been few serious extensive outbreaks of insects in Canadian forests. The Larch Saw-fly has been less injurious in the east, but is extending its western ranges beyond Manitoba and is still very destructive in Western Ontario. Attempts have been made by Dr. Hewitt to colonize the European parasite *Mesoleius tenthredinus* and the parasitic fungus *Isaria farinosa* at several points in Quebec and Ontario and in the Riding Mountains, Manitoba. With such leaf-feeding insects, widespread over great forest areas, the introduction of such foreign parasites and assistance in the distribution of native and established species seems to offer the only hope for any human influence upon the control.

The Spruce Budworm, which caused so much alarm for several years in Quebec forests, has been on the whole much less in evidence this season. We know of no instance in which its injury was followed by extensive Bark-beetle attack.

The control of such species as the Larch Sawfly, Spruce Budworm, Brown-tail and Gipsy Moth and the European Scourge, the Nun Moth, presents tremendous difficulties. In European countries, where the forests are policed by a large body of trained foresters, control measures may be attempted that are not to be even considered in our immense area. There appears to be but one way in which we can influence the extent of the ravages. This is by increasing the numbers in an infested region, of the active parasites which effectively prey upon the pests. With an introduced pest, natural parasites, if not brought with it, may perhaps be successfully introduced and colonized. It is conceivable that in future years parasites will be obtained in quantity in infested districts to be shipped to distant sections of our forest area for the control of incipient outbreaks of the same injurious species. The present status of the Larch Saw-fly in Canada offers an illustration. So far as the relations between this species and its natural control factors have been studied in Eastern Canada, it appears that *Ceolopisthia nematicida* plays a most important part. We have no record of this parasite from Manitoba, where the Saw-fly is now widespread. There is a very serious outbreak in Western Ontario, towards the Manitoba boundary. Whether the parasite is there or not we do not know; but, apparently, as the outbreak is not under control, its numbers are not yet great. We should be justified in attempting extensive introduction of Cœlopisthia into many sections of Manitoba in an endeavour to check the western spread of the pest, provided, of course, supplies of parasites could be obtained.

This distribution of native parasites has already been tried in England and Europe; and, in connection with other insects, has been attempted in various places in the United States.

We know that this Saw-fly at times sweeps over extensive areas in America, and is not controlled by any parasites or any factors whatever. The outbreak at times ceases only with the death of the trees. We cannot depend, therefore, upon native species for permanent control, unless we can materially influence their distribution.

With such an immense area of forest we shall probably usually have Saw-fly outbreaks just under control, with a plentiful supply of parasitized cocoons in certain parts of the country, while in other parts outbreaks will be in their incipient stages.

It appears, then, to be *possible* that we may yet control such species as the Larch Saw-fly in limited areas of our forests, in touch with civilization, by an elaborate system of information and distribution of parasites.

Investigations in England by Dr. Hewitt, and others, have given hope that *Mesoleius* may be much more effective in its control than any native species. The introduction of this species may be of great benefit.

Lophyrus abietis has been quite destructive to spruce shade trees in various localities. I noticed several white spruces in Algonquin Park, Ontario, this summer, completely defoliated by it.

Chermes similis, Gillette, and *Chermes abietis,* Chol., have both been destructive to shade trees and are very common locally in spruce forests. They may be controlled on shade trees by spraying with kerosene emulsion or whale-oil soap; or, on small trees, by picking and burning the galls.

Chermes pinicorticis, Fitch., is a common and destructive species throughout eastern Canada, and seriously injures many young white pines, particularly those growing in the shade.

Chermes strobilobius, Kalt., and *Coleophora laricella* were particularly abundant this year at Ottawa on both European and American larches.

Gossyparia spuria, Mod., is injurious to elms at Ottawa. The young appeared in late June and early July. The leaves below badly infested branches are sometimes entirely covered with a thick coating of wax. This must render the leaf practically useless and contribute towards the weakening of the tree.

Kaliosysphinga dohrnii, Fisch., is common about Ottawa on native and cultivated alder. It occurs on several exotic species in the Arboretum in immense numbers, and quite spoils the appearance of the trees.

Pemphigus acerifolii, Riley. An aphis, probably of this species, was particularly troublesome this year at Ottawa on ornamental maples. During July winged and wingless adults and young were in dense masses on the undersides of curled leaves. Wax filaments and drops of honey dew, whitened by wax, were constantly dropping from the trees.

Schizoneura americana, Riley, was the cause of many enquiries from southern Quebec and Ontario.

Podosesia syringae, Harris, was found at Ottawa destroying stems of lilac. The caterpillars were boring in the base of the stems, excavating the inner bark and sapwood.

Aegeria exitiosa, Say. A caterpillar, probably of this species, has been numerous for some years in a grove of wild cherry at Isle Perrot, Que. Many of the trees have been destroyed by it. *Phloeotribus liminaris* breeds in these trees; but to a limited extent, and appears not to be increasing in numbers.

Galerucella decora, Say., was reported stripping willow and poplar at various points in British Columbia.

Tylonota bimaculatus, Hald., was taken at Ottawa from ash. The larvae were breeding in apparently sound wood.

Cyllene robiniae, Forst, has been destructive in southern Ontario. Considerable injury was caused to ornamental acacias near Kingston, Ont. It is interesting that while acacias were badly injured, locust trees were apparently not attacked.

Pissodes. Various species of this genus have been injurious to spruce and pine. The most interesting reports were from P.E.I., and from the Rocky Mountain Forest Reserve, Alberta. In the latter place there is a rather serious outbreak of

Pissodes in young growth. The effect of an old *Pissodes* injury to spruce is evident in numerous "double-tops" throughout the Riding Mountain Reserve, Manitoba.

Dendroctonus murrayanae, Hopkins, and other destructive bark-beetles, together with many injurious buprestid and cerambycid borers are very abundant in the Riding Mountain Forest Reserve, Manitoba.

Only a limited amount of cutting is allowed in the reserve, and this is chiefly in fire-swept areas. There were several considerable burns in the spring of 1911, and in these the bark-beetles were present in spruce and pine in immense numbers. There were no fires of importance in the reserve this spring, and consequently little cutting of green timber. There is danger of an outbreak of bark-beetles of the genera *Dendroctonus* and *Polygraphus* in the neighbourhood of these 1911 fire areas. One of these species (*Dendroctonus murrayanae,* Hopk.) has already destroyed some timber there; but it is not noticeably common in healthy trees. A few Dendroctonus-killed jack pines may be seen along the Clear Lake trail. Conditions are being carefully watched by the officers of the reserve and any outbreaks will receive prompt attention.

The Larch Dendroctonus, *D. simplex* Lec., is very common throughout the parts visited. It was found in great numbers in dead, standing larches; but whether or not it had been the primary cause of the death of the trees could not be then determined. This species prefers bark in a dying condition, but may become an important auxiliary of the larch saw-fly in future years. *Ips perturbatus,* Eichh., and *Ips caelatus* Eichh., are very abundant in fire areas south of Clear Lake. They are found there chiefly in white spruce, which was badly injured by fire. *Polygraphus rufipennis* Kirby, the spruce bark-beetle, is common everywhere in dying bark of spruce, larch, and jack pine. These species are able to kill weakened or injured trees which might otherwise recover. Other species of bark-beetles of lesser interest are abundant in dying bark of spruce, pine, and larch.

Timber-beetles of several species are plentiful. *Trypodendron retusus* Lec., the poplar timber-beetle, in poplar, and *T. lineatus,* Ratz., the spruce timber-beetle, in spruce and pine, are the most common. These beetles drive their small round, black tunnels more or less deeply into the wood of dying or recently killed trees and logs, or freshly-cut lumber, and reduce its value for all but cheaper purposes. They also assist in the introduction of fungi and bacteria into the wood. Many poplars on the upper plateau are more or less scraped by deer. These scrapings penetrate to the cambium, and present an ideal inoculation-surface for fungi and bacteria. The poplar timber-beetle enters later on these scraped surfaces, and through its tunnels spores may reach deeper layers.

Damage to killed and injured spruce and pine by cerambycid and buprestid borers is extensive. Piled lumber cut in the fire areas by portable mills showed abundant evidence of their borings. The fires occur usually early in the spring. These beetles lay their eggs in slits or crevices in the bark late in June and in July. They seldom deposit their eggs on barked surfaces. The grubs cut large, rounded and flattened tunnels through the bark and wood.

To prevent the injury by these borers it is necessary to bark the trees, or put them in water when possible, before the young grubs have worked through the bark and into the wood, or to saw before they are deeper than the thickness of the slab. Some species will continue their borings in piled lumber, or even in parts of buildings, for months or even years, if they have penetrated deeply before the logs were sawed.

Every effort should be made to get on the ground as soon as possible and to rush the sawing during the first part of the season. Much of the trouble might thus be left in the slab.

Throughout the reserve the poplar is badly infested with fungi, and with boring grubs of the long-horned beetles (*Cerambycidae*). The only conceivable method of controlling either the fungi or the beetles is to cut and burn, at the proper season, all infested trees. Such an operation could not be considered there at the present time, and these diseases of the poplar are likely to continue.

Dendroctonus pseudotsugae Hopk., has been injurious in many places in British Columbia to Douglas Fir; and *Dendroctonus brevicomis* Lec., has attacked and killed healthy yellow pine (*P. ponderosa*) in several localities. *D. ponderosae* Hopk., has been reported destroying *Pinus ponderosa,* Bull or Yellow Pine, over a limited area. In the presence of these, and other bark-beetles of similar habits, British Columbia possesses a very serious danger to her forests. They should be carefully watched and outbreaks promptly and skilfully dealt with.

Dendroctonus valens, Leconte, usually a not very serious secondary enemy of pines and spruce in Eastern Canada, was found this season destroying healthy white spruce. This species is extremely abundant in the pine slash in Algonquin Park. It has entered living bark in large numbers, as evidenced by the pitch-tubes. *Ips calligraphus,* and many species of the genera Ips, Dryocoetes, Trypodendron, Gnathotrichus, Polygraphus, Hylurgops, Pityophthorus, Pityogenes, and others, are present there in myriads in pine and spruce slash of last winter's cuttings. As long as extensive cutting continues there is probably little danger from any species discovered there this summer. When the cutting ceases, as it soon must, the second growth pine and spruce will be in danger.

There was noticed this season in different parts of Quebec Province, in Ontario, and particularly in New Brunswick, a rather obscure injury to spruce and fir twigs. The tips of the twigs appear throughout the early summer, dead, brown and dried. On many twigs there are indications of hemipterous injury, but many show no mark of insect work and contain apparently no parasitic fungi. Much of the work seen this season was difficult to explain. Twigs of spruce, fir and pine are commonly injured by various insects. Certain ipid beetles of the genus *Pityophthorus* are locally plentiful boring in and destroying twigs of white and red pine. Certain hemipterons kill many twigs of pine, spruce, and fur by sucking the sap, early in the season, an inch, or several inches from the tip. Cerambycid and ipid beetles do always more or less damage, and at times a great deal, by gnawing the bark from twigs and branches of pines. Such injury is seldom of importance, except on ornamental trees. Pine twigs, or ornamental trees, bored by *Pityophthorus* should be cut off and burned as soon as noticed.

The Birch Leaf Skeletonizer, *Bucculatrix canadensisella,* Chamb., has been abundant and injurious, notably about Port Arthur, Ont.

The Pine Leaf-miner, *Paralechia pinifoliella,* Clem. This interesting miner was abundant at Ottawa this season on cultivated jack pine, *Pinus banksiana.* The larva works within the distal half or more of the leaf, sealing up the entrance-hole at the base of the cavity with a silken film and pupating within. Adults were emerging this year during the last week in June.

An interesting outbreak of *Monohammus scutellatus* occurred this summer on pine about Port Arthur, Ont. Immense numbers of the adults were feeding upon the bark of twigs and branches of sound trees.

There was an interesting outbreak this season in some of the St. Lawrence Island parks of *Elaphidion villosum*. Thousands of branches of oaks were broken, some hanging to the trees, and others scattered about the ground. These branches were gathered and burned. This will probably prevent a recurrence next year.

Saperda calcarata is a very destructive enemy of poplar in the east and also in Manitoba. Throughout parts of the east it is particularly difficult to preserve poplar shade trees on account of its ravages. It infects the trunk and larger branches, and I have taken it from the heart of the largest balsam poplars. Very careful inspection and removal of the borers in the fall may prevent injury to valuable shade trees, and the older grubs can be removed with a knife or killed by benzine or carbon bisulphide injected into their borings.

Agrilus anxius. This injurious species is very destructive to imported white birches about Ottawa. Native birches appear always better able to resist its attack.

Mr. Caesar: Have you ever discovered on pine branches swellings from half an inch to an inch and a half in diameter due to a species of *Peridermium* probably *P. cerebrum?* In parts of Lambton County pine trees are being injured by this disease.

Mr. Swaine: Yes, in the West, on jack pine and mountain pine and, in the east, on jack pine, such *Peridermium* galls are very common.

Dr. Walker: Have you seen anything of *Retinia* on pine this year?

Mr. Swaine: Yes. It has been rather common in the West, particularly in the Rocky Mountain reserve, Alberta. Its work is usually found more or less commonly throughout our eastern forests, but I have no record of special outbreaks there this season.

Dr. Walker: Mr. J. H. White of the Dept. of Forestry, University of Toronto, sent me a number of twigs of jack pine infested with a species of Retinia, from Sudbury, Ont., where he said they were very abundant.

Dr. Hewitt: I was very glad that Mr. Swaine emphasized the question and discussed the importance in the control of the Larch Sawfly, of transporting the parasitic enemies from one locality where they are extremely abundant, to another locality where the attack of the sawfly is not so severe. This has been done in the case of a number of other insects which we know. About five years ago I recommended and also started in England a system such as Mr. Swaine suggests, of aiding the natural control of the Larch Sawfly, and I believe the Board of Agriculture in England have continued it. The method I recommended is this: I made a careful study of the percentage of parasites and the increase. If an increase in parasitism was observed sufficient, as I believed, to be of material assistance in obtaining control, cocoons were to be collected and transferred to localities where an outbreak of the sawfly was in the incipient stage. This seems to be the only possible alternative to the introduction of parasites from outside and is one which could very well be adopted. What must be done in these cases, however, is to keep a very close watch, as Mr. Swaine suggests, on the outbreak from time to time when it begins and notice from year to year how the parasites increase in abundance. This is the method I adopted in England. From year to year the percentage of parasites increased, and as it increased it showed that the control of the natural parasites was very efficient. I hope that we shall be able to carry on some experiments in this country on these lines.

AQUATIC INSECTS.

Robert Matheson, Truro, N.S.

Water is the most abundant mineral of our earth. It covers at least ¾ of its surface, and also constitutes a large part of our continents, Fuller estimating that the entire amount of underground water would form a belt 96 ft. in thickness. W. J. McGee estimates that the first 100 ft. of ground of the United States contains 17 ft. of water. Water is the most essential of all compounds. All living organisms consist of a large percentage of water. Undoubtedly life originated in the water, and to-day all forms of life are more intimately associated with water than with almost any other single substance. It is not necessary for me to enumerate the many peculiarities of water, its color, odor, freezing and melting temperatures, its specific and latent heat, its point of maximum density, the formation of vapor, rain, fogs, dew, frost, etc., its solvent powers, etc., etc. Yet all these chemical and physical properties of water are what makes life possible on our globe. Is it any wonder then that our seas, lakes, rivers, ponds, and streams teem with living organisms?

Turning our attention to the insects, there is no question that they constitute the dominant animal group. Insects are more numerous in species, constituting 4-5 of the known forms, but also probably exceeding in actual bulk all other terrestrial animals. From such considerations one would be inclined to conclude that insects would be found in great abundance in our waters, yet the very opposite in the case. Our great oceans and seas are practically devoid of all insect life, only one genus of water striders, *Halobates,* being found distant from our shores. In our inland waters, insects are found near the shores, in shallow water, among aquatic vegetation, only a few forms being found in the Plankton (*Corethra*). The open water is practically devoid of all insect life. Aquatic insects are practically all littoral.

The explanation of this paucity of forms is found in the fact that all insects were originally terrestrial animals. The evidences of this are so numerous and obvious that I need scarcely recount them;—

(1) The chitinous armour, impermeable to water and air.

(2) The taking in of air through open spiracles.

(3) No insect form breathes air dissolved in water throughout its life.

(4) Many aquatic larvae breathe air directly.

(5) Larvae possessing gills are widely distributed and not restricted to any one group or closely associated groups.

(6) No adult insects are true aquatics, breathing air dissolved in the water.

Undoubtedly like many mammals, insects have become readapted to an aquatic life. This readaption has probably been brought about either by the scarcity of food on land or its abundance in water, or by both, and as a result of the terrible competition existing among land forms. Gradually certain forms have pushed their way out into the water and this adaptation to an aquatic environment has arisen independently in widely divergent groups. At the present time scarcely a single large order is without aquatic representatives. In many of these orders the aquatic habit has risen independently several times. Miall estimates that adaptation to aquatic situations has risen independently at least one hundred times. To the student of evolution no other single class offers such a tempting field for the study of adaptation to a common environment by many widely divergent forms.

As we glance over the Hexapods we find comparatively few adapted to aquatic life, not one single order which is wholly aquatic throughout the larval and imago states. The Ephemerida, Odonata, Plecoptera, Trichoptera are all aquatic in the larval state, the adults being aerial. Part of the Neuroptera, some rare Lepidopterous forms (Hydrocampa, Paraponyx), are aquatic in the larval state, and several large families of Hemiptera and Coleoptera are aquatic throughout their entire existence. Yet the species comprising these families are nearly all terrestrial in their mode of obtaining their air supply. Some rare hymenopterous forms are also aquatic, parasites on the eggs of various insects which depost their eggs in water. As yet but few of these parasites have been reared, though undoubtedly many exist. It is an inviting field for anyone interested in discovering new things.

Despite the comparatively few species of insects, probably not more than 15,000, which are aquatic in their habits, we find here some of the most remarkable adaptations. In the May-fly group alone we find the various genera adapted to the most diverse aquatic environments. We find them in the swiftest streams and waterfalls (Heptagenia, Epeorus, Iron, etc.), in more or less stagnant ponds (Blasturus, Siphlurus), in the quieter streams and riffles (Callibaetis, Leptophlebia), and burrowing in the mud and ooze at sides or bottoms of ponds (Hexagenia, Caenis, Tricorythus, Ephemerella). Some of the May-fly species are admirably adapted to one particular environment as those of Iron while others are capable of living under a greater diversity of conditions (Leptophlebia, Ephemerella). In nearly all the aquatic groups we find more or less of a parallel development, each species well adapted to the situation in which it lives.

I shall not attempt a detailed discussion of the various modifications which were necessitated by the change from a terrestrial to an aquatic environment. Probably the most difficult situation which the aquatic forms had to meet was the securing of air supply. And to solve this difficulty we find insects have developed a great variety of structures. And these structures have certainly developed independently in widely divergent groups. There are practically two methods by which any form can secure its air supply. (1) By coming to the surface and breathing air directly, (2) By means of either tracheal gills or blood gills and thus making use of the air dissolved in the water.

I shall discuss the first method hurriedly. Those forms that secure their air supply directly at the surface are found in widely separated orders. Many of these species have developed very complicated and beautifully adapted structures. In the Hemiptera many forms have developed pile on the surface of the body enabling them to carry down an air supply (Notonectidae). Very little is known concerning the methods by which members of the family Belostomidae secure their air supply. In Belostoma there are areas of pile on the under surface of the body by means of which an air supply is carried. The antennae are wonderfully modified, somewhat analogous to that found in the Hydrophilidae but it is not known whether they are used in securing an air supply. In Nepidae the caudal stylets have been modified into a tube which is pushed through the surface film and thus an air supply is obtained. The aquatic members of the Coleoptera also take down an air supply. In the Haliplidae I found quite a new adaptation for securing air (Jour. N.Y. Ent. Soc. xx, pp. 180-181, 1912). Everyone is familiar with the method by which members of the Dytiscidae secure their air supply. In the Hydrophilidae the terminal club of the antennae which is pilose acts as the

agent by which air is transferred to the pile covering the under surface of the body. It is extremely interesting to watch a hydrophilid beetle come to the surface, break the surface film by means of its antennae and bending it back so as to touch the prothorax there is formed an opening bordered by the angle between the head and pronotum and the antennae outside. Down this opening the transfer of air takes place. How it is done I do not know. So far I have discussed only the adult Coleoptera. All larvae of Dytiscidae obtain their air supply by coming to the surface, the terminal segment of the body usually being provided with a large pair of spiracles. This is also the case with most Hydrophilidae, though a few undoubtedly obtain their air supply by means of tracheal gills (Berosus). In the Haliplidae I have described the method of securing an air supply by the larvae of Peltodytes. This method is probably one of the most remarkable yet described for Coleoptera. In the Donaciinae the larvae live on the submerged roots and stems of aquatic plants, spatterdock, etc., and obtain their air supply by puncturing the stem by means of two powerful anal spines. At the base of these spines are the spiracles which are thus placed in contact with the air in the inter-cellular spaces of the plant. This is certainly one of the most remarkable adaptations for the obtaining of an air supply.

In the Diptera there are many aquatic larvae which obtain their air supply directly at the surface of the water. This is found in the aquatic Crane-flies, the soldier flies, Culicidae and others. In the Syrphidae we find the rat-tailed maggot which is provided with a long anal process. This is projected through the surface film while the possessor revels in the filth below.

There are three ways by which aquatic larvae may obtain their air supply from that dissolved in the water.

(1) Extremely thin-skinned forms which live among algae or rushing water where oxygen is abundant. Here we have Ceratopogon (Punkies) in algae, some very small non-case building caddis worms and a few stone flies (Chloroperla) which live in rapids.

(2) Blood gills. This, the true mode of respiration among aquatic organisms, is rare in the insect group. We find it practically confined to a few dipterous forms as Chironomus, Simulium, and an amphibious Cranefly, etc.

(3) Tracheal gills. This method of securing an air supply is widely distributed and is but a modification of the ordinary tracheal respiration. Tracheal gills are only extensions of the body wall into which run tracheae and their attendant tracheoles. These are found under several different forms:—

(1) Filamentous as in the Caddis-worms, Stone-flies, some Lepidoptera (Paraponyx), and is probably the most primitive.

(2) Lamelliform as in many Mayfly nymphs, and Damsel-flies.

(3) Modification of the posterior end of the alimentary canal, Dragonflies.

I shall not attempt to discuss at any length many of the other modifications necessary for aquatic life. As the aquatic Coleoptera have become better fitted for rapid locomotion than any other forms it may be well to glance at their adaptive modifications. Prof. Osborn in the American Nat. for Oct., 1903, has described and adaptive modifications of aquatic mammals. Prof. Needham and Miss Williamson in the same magazine for Aug., 1907, have shown that many of these modifications find their parallel in the Dytiscidae. I may mention some of them: (1) Rigidity of the body which has been brought about by compacting and co-adaptation of the external parts of the skelton. This co-adaptation has

been well described by David Sharp in the Transactions of the Royal Dublin Society for 1882. (2) Diminished resistance by,—

(a) Rounding of the contours giving a boat-shaped form.

(b) Depression of the eyes.

(c) Loss of hair and sculpture.

(d) Flattening of hind legs in horizontal plane.

(3) Increased efficiency of swimming of the hind legs. (4) Lowering the centre of specific gravity by the formation of an air cavity under the Elytra.

I cannot leave this discussion, however short, of the adaptation of aquatic insects without again calling attention to this inviting field of research. Very little has as yet been done, none of the groups have been monographed and but few life-histories have been studied in detail.

Turning our attention now to the economic significance of this insect life of the water. These aquatic forms may be grouped into two general classes, herbivors and carnivors. Now the primary crop of our waters, ponds, lakes, streams, is fish. In order to utilise our ponds, streams, and lakes to their fullest extent it is necessary that they produce a crop which will be of value to man. How is this to be bought about? Can we not utilise this insect fauna to our own advantage? In other words why should we not have a system of water culture. Before we can have any such system it is first necessary to know our water fauna and flora. I mean know in the sense of life-histories, habits, food, times and rate of reproduction, means of propagating, isolating, etc., all those things that a progressive farmer must know before he can successfully raise crops. It is becoming more and more essential with our increasing cost of production and consequent high cost of living that we utilise our open lakes, ponds and streams so that they may produce a valuable crop as fishes. As Professor Needham has so often pointed out, water is one of man's primary pleasure grounds and sources of food supply. At present it provides but a poor and uncertain crop which certainly could be doubled and trebled if we only could develop as successful a water culture as we have a land culture.

In order to have a successful water culture we must have (1) Isolation and growth in pure culture, in other words we must eliminate or lighten the struggle for existence.

(2) Provide suitable environment.

(3) Control the food supply and enemies.

(4) Provide suitable varieties.

So far as insects are concerned in a successful water culture they are important as a food supply, and in many cases dangerous as predaceous on small fry as well as on insect herbivors. Prof. S. A. Forbes has shown in his studies on fish food that insects constitute an important supply. He found Mayflies, Midges, (adults and larvae), Caddis-worms, Water-boatmen, etc., in their stomachs. When we consider the enormous egg production of such mayflies as Callibaetis we see at once an important source of food supply particularly when we are able to control the rearing of these forms. Then there are periodic forms as Blasturus, Siphlurus, Ephemera, Choroterpes, giving us an enormous food supply. So also amongst Dragonflies. Then what an enormous food supply when we are able to control the rearing of the many forms of aquatic Diptera, Trichoptera, etc. Though many of the more general features of the life-histories have been worked out, very little has been done in the way of successful rearing of these forms as the

basis of a permanent food supply for fishes. Along with the rearing of the forms suitable for fish food it will always be necessary to keep out of our ponds the predaceous forms such as the larger species of Dytiscidae and Hydrophilidae. In my limited observations on these forms I found them to attack small fish and kill them very easily. So it will also be necessary to carefully study the predaceous forms in order to lessen the dangers of fish culture.

The basic food of our fresh waters is vegetable, largely plant plankton. This forms the basis for the animal plancton which in turn provides the food supply for the younger fishes. Our herbivorous insects in turn provide a considerable food for larger fishes while these in turn are devoured by larger fishes. If we see to it that the final product is a profitable crop of edible varieties of fish we will at least have laid the foundation of a successful water culture.

All of us are compelled to earn a living, and the economic problems at present awaiting solution provide us with means for a livelihood. These problems are mainly concerned with the growing of land crops. Surely the future will also find us hard at work developing a successful water culture. In the meantime anything which we can do by adding one life-history of an aquatic form or isolated notes may be of use in the future, and will be of permanent value.

Dr. Walker: I am very glad indeed that this subject has been brought up again. I think that most of us who heard Prof. Needham's address at the Annual Meeting two years ago realize, for the first time, the great possibilities offered by our large tracts of swamp water in the artificial cultivation of aquatic insect larvae as food for fish. Our fresh water fisheries are becoming rapidly exhausted, and it is high time that more active steps were being taken to prevent any further depletion of these important natural resources. It is only by such careful investigations of the food of fish and the means by which it may be cultivated that a sound basis for such work can be obtained.

Dr. Hewitt: I should like to thank Dr. Matheson for his interesting address and also to state that there is really no necessity for him to apologize, as he seemed to be doing, for bringing forward a paper which is of the utmost economic importance. Dr. Matheson said that there is a great necessity for our study of aquatic insects. It seems to me that the proper place for studies of that kind is at the universities. Students who are looking for subjects for research work are the ones to take up this kind of study, as we cannot at present afford to devote our time to problems primarily involving a large amount of investigation along lines not of an immediate economic nature. I regard that owing to the fact that there are so few of us at present working on the economic aspects of entomology we are in consequence so extremely busy with our own branches of work. Therefore, I would suggest to Dr. Walker and others in charge of research at our universities and colleges that those students might devote their time, that is, those with inclinations in these directions, to studies of this kind; the students in universities and colleges are those in the best position at the present time to carry on these investigations. We heard with great interest Dr. Needham's address two years ago on this important subject. Dr. Matheson has again called attention to the important relations of a study of aquatic insects to the question of the conservation of our fresh-water fish supplies. I would suggest that we take some definite action in this matter and that we move a resolution calling the attention of such a body as the Commission of Conservation, who have to deal with the conservation of our fresh water fishes, etc., to the necessity of

investigations of this kind, namely, the study of the food of our fresh-water fishes in relation to their conservation. This matter has a very important bearing on the question of our national food supply. I think if a resolution of this nature were passed and forwarded to the Commission of Conservation it would do much good and would be preferable to our retaining our opinions on this vital matter to ourselves. I beg to propose, therefore, the following resolution:

"That in view of the decrease in the supply of the fresh-water fishes of Canada the attention of the Commission of Conservation be called to the important fact, which is being overlooked in the endeavours to replenish depleted waters by restocking and to stock new waters, that as the chief food of many of our important fresh-water fishes consists of larval and adult insects a study should be made of the available or possible food supplies in the way of insect life before attempts are made at replenishing or stocking waters; otherwise, by stocking waters in which the food supply is not suitable or cannot be made suitable, large sums of money and considerable time and energy will be uselessly expended owing to fish being planted where the food is either insufficient or of the wrong character, as the conservation of our fresh-water fishes cannot be successfully carried out until more knowledge is available as to their feeding habits and requirements, and concerning the insect and other fauna and available food supplies of the waters in which they are living or which it is desirable to stock with fish, and that a copy of this resolution be forwarded to the Secretary of the Commission of Conservation.

Mr. Swaine: I am glad to second such a motion.

The resolution was put to the meeting and carried unanimously.

INSECT PESTS OF SOUTHERN MANITOBA DURING 1912.

Norman Criddle, Treesbank, Man.

In this paper an attempt is made to give a brief account of the more prominent insects found attacking both vegetation and live stock in the vicinity of Aweme, Manitoba, during the season of 1912. Broadly speaking, there are a number of insects, of which we know comparatively little, doing considerable injury to crops that require careful study, not only in Manitoba, but in Saskatchewan and Alberta also. In all these provinces the enormous acreage under cereals has placed almost unlimited food at the disposal of insects that formerly existed only in a few native grasses, and which were controlled very largely by the condition and prevalence of the plants they inhabited. Under the new conditions there is no telling how far afield some of these species may spread, or how much damage they may accomplish.

During 1912 several insects were present in damaging numbers, of which the following were most noticeable.

1. Insects Injurious to Grain and Grasses.

Hessian Fly. This species was present in small numbers in late June, when a few larvæ were discovered near the base of wheat plants. On July 13 a few pupæ were secured, of which, unfortunately, all but one died. This single in-

dividual produced a fly on September 6th, thus adding more evidence to the probability of the species having a very similar life cycle to that which it has in the east, instead of being, as was formerly supposed, single brooded. Much more evidence is required, however, before this point can be settled definitely. Incidentally it may be mentioned that, according to the Alberta Department of Agriculture, quite extensive injury was done to winter wheat in that Province this season, and as no knowledge of its life history is available in those parts, and consequently as no precaution are taken in sowing wheat to escape this fly, it would not be surprising if a very severe outbreak occurred there at any time.

In Manitoba, at least half a dozen points reported Hessian Fly damage, but doubtless some of this, at least, are referable to other insects.

Greater Wheat-stem Maggot. This insect was present at usual in fair numbers but occurred more plentifully in native grasses than in growing grains. Adults of this species can be collected as a rule, from May to the middle of September.

Small Wheat-stem Maggot. A species that I expect to be *Oscinis soror,* but have not been able to get identified,* was present in considerable numbers early in the season, and did extensive injury to spring wheat, often giving whole fields a patchy appearance, and in spots killing out fully half the plants—killing them so completely, too, that viewed from a distance the patchyness of fields gave the impression of the grain having failed to germinate. And as a matter of fact, a few farmers thought this was the cause. Later, in June and July, another generation occurred and I found them to be quite plentiful both in the larval and pupal stages at or near the bases of wheat plants. Many of the side shoots (stools) thought to be killed by the combination of heat and drought were in reality destroyed by the maggots of that fly. Pupæ collected on July 13 produced adults from July 19 to the 27th. So there would be another brood before winter set in—probably in volunteer wheat and such native grasses as were within reasonable distance.

Western Wheat-stem Sawfly (*Cephus occidentalis*). This sawfly was again very troublesome and appears to have been quite widely spread over the Province. Wheat and rye suffered in equal proportions and in some instances round the edges of fields there was a loss of fully 75 per cent., the injury extending into the grain for several hundred feet, though gradually getting less severe towards the centre of fields.

Deep ploughing, not less than six inches, if done in the fall, appears to be enough to prevent the flies emerging next June. It is also effective in the spring if packed afterwards, loose shallow spring ploughing is, however, quite valueless.

Grasshoppers. We had another rather severe outbreak of these insects, June and early July being particularly favorable in weather conditions for their depredations. They were also present in damaging numbers in other districts. They were, however, in most instances kept within reasonable bounds by means of horse droppings, salt and paris green and the only real injury here was done after they could fly when scattered through the crop they attacked the heads of all kinds of grain They also did some injury by gnawing through binder twine used to tie sheaves. Cool wet weather in July and August had, however, a marked effect upon them. To begin with those adverse conditions prevented the usual migratory movements by means of which they are distributed over the

*Through the kindness of Mr. J. W. Johnson this species has been determined as *Oscinis carbonaria.* C. G. H.

country before they commence to breed. Consequently very few left the neighborhood in which they were hatched. Secondly, these conditions assisted the disease—*Empusa grilli*—that had already become thoroughly established the previous year. Many were killed for this cause. Others were attacked by parasites, and yet others from general weakness due to lack of sunshine, dampness and cold; so that by the time egg laying commenced fully half the total number had vanished from the causes mentioned. Many of the remainder being weak and climatic conditions being still adverse, failed either to deposit any eggs at all or only laid a small number in comparison to what a vigorous grasshopper usually does.

In spite of all these unfavorable conditions, however, a large number of egg masses have been deposited of which less than ten per cent. have been destroyed by insect enemies, so that unless these are still further reduced before next May, or the weather is still adverse when the nymphs should appear, we may expect another outbreak next year, though less severe than during 1912.

The commoner species present were *Melanoplus atlanis, packardi, augustipennis, bivittatus femur-rubrum dawsonii,* and a few others. *M. spretis* has not been observed for several years past and is not indigenous to these parts.

2. Insects Attacking Roots and Vegetables.

Root crops were on the whole remarkably free from insect depredations. The Colorada Potato beetles, however, are still increasing and have made potato growing considerably more expensive than formerly. The beetles still seem wonderfully free from enemies. This species has also caused considerable annoyance in gardens by eating flowering species of *Nicotiana.*

Another potato pest of which many complaints were received was the small black Blister-beetle *Macrobasis unicolor* var *murina;* under natural conditions it lives upon wild peas, vetch and loco weed, but at times of abundance attacks both potato and beans. It has in the past been compared with *Epicauta pennsylvanica,* which is a larger insect.

Turnip Beetles (*Entomoscelis adonidis*) were also rather more plentiful than usual and apart from their attacks upon turnips made a specialty of Virginian stock.

Pepper Grass Beetle (*Galerucea externa*) appeared again in enormous numbers, but as it confined itself chiefly to *Lepidium* and a species or two of Arabis, it could hardly be objected to.

Another beetle as yet only useful which appeared in abundance in certain restricted localities was *Disonycha triangularis* which at present has only been found breeding in and eating lambsquarters. Whether it would also attack spinach if that plant were placed within its reach remains to be seen.

All root-maggots were hardly to be found during the year; cut worms, too, were less plentiful than usual; while the small cabbage butterfly after causing almost a complete loss of untreated cabbage, etc., a couple of years ago, has now become quite a rarity. Strange too, the species it was thought to be replacing, *P. protodice,* is now quite common again.

3. Insects Attacking Trees and Live Stock.

Several well known insects were observed doing injury to trees, foremost among them being the Larch Sawfly; which, as during the previous year, defoliated most of the larches, though it did not last as long as usual, and the trees sooner

regained their greenness by means of a second growth. I believe, too, that enemies were working among them, as a few specimens were found dead in positions that looked very like the work of a fungus. The sawflies were, however, very widely spread and were collected many miles away from their food plant.

Another pest which made much progress and did considerable mischief to spruce was the Spruce Sawfly (*Lophyrus abietis*). Some trees were entirely stripped of their foliage and being evergreens the appearance and effect is much more lasting than larch sawfly work. The insect itself is also quite different in habit, excepting during the larval stage. The larvæ appear in June from over wintering eggs and though varying in size are nearly all fully developed by the middle of July. They then spin cocoons on the leaves or beneath the branches—not beneath dead leaves or moss on the ground as does the larch sawfly. From these the flies emerge in August, lay their eggs and die before winter sets in.

Poplar Leaf Beetle (*Lina tremulae*). Has again become a pest of considerable magnitude—very few aspen poplars were free from them and many small ones practically defoliated. During July and August nearly every grove of poplars was tainted by the disagreeable odour given off by the larvæ.

Willow Leaf Beetle (*Galerucella decora*) again appeared suddenly over a restricted area covering not more than a hundred acres of wood land. They had evidently alighted after one of their usual spring excursions—but disappeared again after a few days, so that little injury was accomplished.

Of other woodland pests the larger Poplar borer, *Saperda calcarata,* was perhaps most conspicuous. It seems to confine itself to certain groves which it eventually kills. The most practical remedy is seemingly to cut down and burn all infested trees.

Among the enemies of live stock may be mentioned an unprecedented outbreak of Stable-flies *Stomoxys calcitrans,* which caused great annoyance to both horses and cattle. It was also troublesome to dogs, particularly to their ears, which were rendered quite raw by the succession of flies that attacked them. Curiously enough, the enormous increase in *Stomoxys* has been accompanied—no doubt coincidentally—by an almost total disappearance of horse flies which reached their greatest abundance in 1910 when they were present in millions. This season even single individuals were hardly procurable.

The usual mosquito pests, house flies, and those of lesser importance were present, but departed very little from the normal in numbers.

SOME NEW OR UNRECORDED ONTARIO INSECT PESTS.

L. Caesar, B.A., B.S.A., Guelph.

Rhagoletis fausta. O.S. On June 22nd of this year I visited a cherry orchard near St. Catharines to see whether any adults of the Cherry Fruit Fly had yet appeared. At this date a few, but only a few early varieties of sour cherries and some sweet cherries were ripening. Montmorencies were still quite green. About 100 specimens of *R. cingulata* were observed. There was no indication of egg laying yet. On my way home I called at another orchard about two miles away in a different direction from the town. While examining some pear trees which formed

a row along the east of an old cherry orchard I was surprised to see many flies that even to the naked eye appeared different from cingulata and resembled much more closely *R. pomonella,* the Apple Maggot. I felt sure, however, that the latter would not yet have emerged. On closer examination I saw that these flies had no whitish crossbands on their abdomens, and that the dark crossbands on the wings were not arranged in the same manner as those of either cingulata or pomonella. Accordingly I had several sent to Prof. Aldrich who stated that they

Fig. 35.—Black-bodied Cherry Fruit Fly (*Rhagoletis fausta*), much enlarged. This fly is a little larger than the following species.

were Rhagoletis fausta—the species which he had described on Page 70, Vol. XLI of the *Canadian Entomologist* as *intrudens* but later discovered to be identical with *fausta,* the name that Osten Sacken had given it in 1877. Before I had any reply from Prof. Aldrich I received a letter from Mr. Illingworth of Cornell University who said that one of our students who happened to be with me the day I found this species had called on him and shown him specimens of the insects which he had taken with him to Cornell. In his letter Mr. Illingworth kindly gave me the name of the insect and some information on the degree of prevalence in his state.

Fig. 36.—Cherry Fruit Fly (*Rhagoletis cingulata*), much enlarged. This fly is a little smaller than the House Fly.

Fig. 37.—Adult of the Apple Maggot or Railroad Worm (*Rhagoletis pomonella*), much enlarged. This species is about the same size as the one pictured in Fig. 35.

During the weeks that followed I examined as many cherry orchards as I could to see how widespread the species was and how it compared in numbers and destructiveness with cingulata. At St. Catharines cherry orchards infested with this species were practically free from cingulata and *vice versa.* It seemed to be nearly as widespread in that district as cingulata and was probably just about as destructive. At Grimsby both species were found in the same orchard and apparently in about the same proportions. In many other orchards there were cherries containing maggots of fruit flies, but as I did not see the adults I could not tell which species they belonged to. Mr. Illingworth states that

fausta is quite destructive to Montmorency cherries in New York State. Osten Sacken got the specimen he named from New Hampshire, and Aldrich says in his letter that he has had several reports of it in the Eastern States. The specimen he described in 1909 in Can. Ent. was from British Columbia, and I notice that Mr. A. Gibson has added a note to Aldrich's article stating that this and not *cingulata* is probably the species that caused considerable damage to cherries in British Columbia. The chances are, therefore, that it is a well established pest that has been with us for years, but overlooked.

The most striking differences between it and cingulata are that it is consciderably larger—this was the first thing that caused it to attract my attention—the abdomen is black, lacking the white crossbands, and the dark crossbands on the wings are very differently arranged. That it was found on the pear foliage was apparently due to the pears being the outside row and the insects having a better chance here to enjoy the sunlight than among the crowded cherry trees. About two weeks later most of them were visible on the cherry leaves and fruit, and very few on the pear. On June 22nd, the date of their discovery egg laying had apparently not begun.

Fig. 38.—Work of Plant Bugs (Capsids) on young apples.

Capsids Attacking Apples.

Four years ago my attention was called by Mr. Joseph Tweedle to the large number of more or less deformed fruit in his apple orchard, situated about twelve or fourteen miles south-east of Hamilton. On examining the apples I suspected that insects of some kind might be the cause; accordingly the next spring (1910) I visited the orchard a week or so after the blossoms had fallen and succeeded in discovering several Capsid nymphs feeding on the fruit and producing depressions or scars wherever they had fed. About a dozen were collected and taken to Guelph, but in my absence the adults reared from them were not looked after, and moulded in the breeding cages. The nymphs were greenish in color, with brownish or reddish brown wing pads, and most of them, at least, had conspicuous, hairy antennae. No red nymphs were seen anywhere. In the spring of 1911, I again visited the orchard and found the same type of nymphs present. One or

two red nymphs were found on this occasion, but they were very rare indeed. From the former nymphs brought to Guelph, six adults representing two species were reared. Three of these were sent to Mr. Van Duzee who kindly identified them as *Paracalacoris colon,* Say and *Neurocolpus nubilus* Say. Four out of the six belonged to the latter.

This spring I thought that even though neither Mr. Baker or I had time to devote to a careful study of the life history of these insects, it might be possible by occasional trips to make some interesting and perhaps valuable observations on their habits and work. Accordingly on June 12th, when the calyces of the apples had just closed, Mr. Baker and I visited the orchard and found a good many of the nymphs feeding as in previous years on the fruit and tender part of the twigs. To our surprise many red nymphs were also seen, especially on the shoots that grew up from the crown of the trees. None of these red nymphs, however,

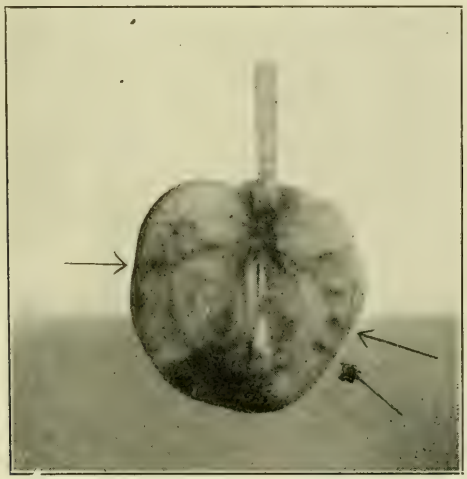

Fig. 39.—Section of deformed apple, showing small brown areas caused by feeding of young Plant Bugs (natural size). Photo taken June 25th.

were seen on or close to the fruit: but that this species (*Lygidea mendax*) as well as *Heterocordylus malinus* does feed on young fruit in addition to the leaves, has been shown by Crosby.

On June 25th, we again made a hurried trip to the orchard. The fruit at this time averaged about half an inch in diameter and the nymphs had almost entirely ceased to feed on it, though two or three were doing so. They evidently now much preferred the tips of the shoots around the base of the tree. The red nymphs here were about as numerous as the other species, but owing to their brilliant color were more easily seen. Forty or more nymphs were taken to Guelph, and twenty-two adults reared from them. All the red nymphs—four in number—proved to be *Lygidea mendax,* the False Red Bug, and the rest *Neurocolpus nubilus* and *Paracalacoris colon,* six belonging to the former and twelve to the latter; many of the red nymphs had died, being apparently less

able to stand confinement on the way to Guelph.

On this second trip we had tagged a dozen apples that had been attacked, and as I was anxious to see what these looked like, and to discover what the adults were doing, I visited the orchard on July 20th, about a month after our second trip. The apples were now from one to one and one-half inches in diameter. The tagged ones, as shown in the photograph, were badly deformed. One had dropped.

My search for adults resulted in capturing two specimens of *Paracalacoris colon*, five specimens of *Lygidea mendax* and eighteen specimens of *Neurocolpus nubilus*. The first species was taken on the shoots around the base of the tree, no more of the species were seen; the second was chiefly taken in the same place, but one was on some weeds in the orchard. One or two were seen up in the tree but could not be caught. Of the eighteen specimens of *Neurocolpus nubilus*

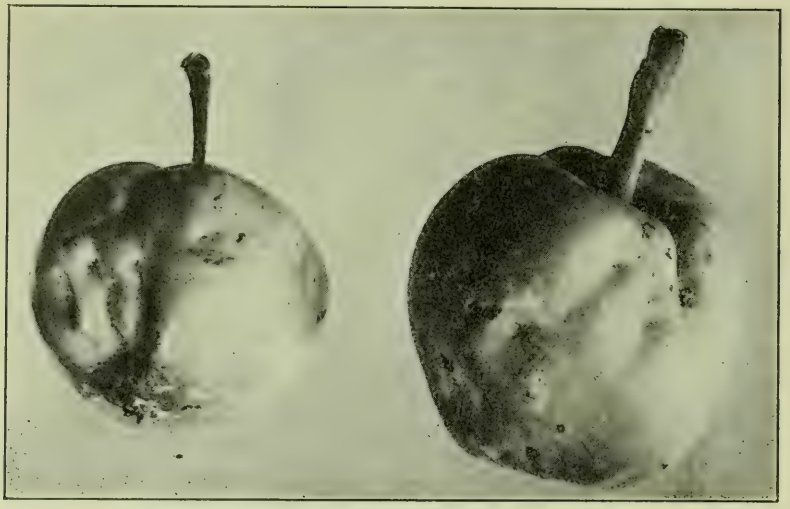

Fig. 40.—Spy apples nearly half grown, showing deformities caused by feeding of young plant bugs when the apples were very small. Photo taken July 20th.

two or three were taken on the apple shoots along with the other two species, but the rest were captured on the following weeds along the orchard fence: catnip, mullein, teasel, cone-flower, red-raspberry (both leaves and fruit) and ground cherry. A search on these and other weeds fifty or more feet away from the orchard resulted in finding none of the three species though *Lygus pratensis* and two or three other Capsids were very numerous.

Examination of the shoots growing up from the base of the apple trees showed that from two to six inches or so of the tip of almost every shoot had been severely injured by the feeding of the Capsids. These shoots were to be found around many trunks and in every case they had been badly injured. The injury at a distance could easily be mistaken for Blight (*Bacillus amylovorus*), but was quite different when viewed near at hand. Some of the tips of the stem were colored orange red, but whether this was due to the Capsids I could not decide, especially as I had only two hours in all to spend in the orchard.

The total amount of injury to the fruit this year would probably not exceed

five per cent., and not every apple that had been punctured was sufficiently deformed to consider it a cull though very few could be classed as No. 1.

I regret that descriptions of nymphs were not made with sufficient care to be reliable, and that we have not yet had a chance to make a study of the life history of each species. So far as I can see, however, from the fact that the attacking nymphs are very small when the apples are just forming and that both *nubilus* and *colon* seem to keep pace with *mendax* in development, the life history of the former two will probably closely correspond to that of *Lygidea mendax* and *Heterocordylus malinus* as given by Crosby.

It may perhaps be of interest to note that Mr. Van Duzee states that he usually finds *Neurocolpus nubilus* on Sumach and *Paracalacoris colon* on Bladder-

Fig. 41.—Tips of tender shoots killed by young plant bugs.

Nut. I examined carefully sumachs about half a mile from the orchard, but could find no Capsids on any part of them. There were no Bladder-Nut bushes near.

I have taken specimens of *Heterocordylus malinus* on a couple of occasions in the vicinity of Guelph, but have not yet been able to prove that they cause any damage to apples in Ontario. Professor Parrot has found that another Capsid, *Lygus invitus,* does considerable damage to pears. I have not yet happened to observe any injury from it in this Province, though probably it is doing some.

Almost every place I go, and especially at Institute meetings deformed apples and pears are brought in by farmers who are anxious to know the cause. From the nature of these deformities I feel that a large field for investigation is still open to entomologists, though of course a good many deformities come under the province of the plant pathologist equally as much as under that of the entomologist.

NOTES ON INJURIOUS INSECTS IN BRITISH COLUMBIA IN 1912.

R. C. Treherne, Division of Entomology, Ottawa.

The following notes and observations were made during the past season. Except for a visit to the States of Oregon and Washington, returning by way of the Lower Kootenay district and the upper region of the Okanagan, I spent the entire summer at Halgie, in the Fraser Valley, where the Dominion Entomological Field Station was located. Particular attention was paid to the insects of the smaller fruits, and the chief insect studied was the Strawberry Root Weevil (*Otiorhynchus ovatus*) the most serious insect pest of this district.

Apple Insects and Others.

The Bud Moth (*Tmetocera ocellana*) was particularly abundant in the orchards of the Lower Fraser Valley this summer and undoubtedly affected the crop to a marked extent.

The Tent Caterpillar (*Malacosoma erosa*) was also especially abundant, complete defoliation of apple trees resulting in some cases. This insect is an annually occurring pest in the Fraser Valley, and yearly causes considerable annoyance to fruit-growers. Through the agency of the Agassiz Experimental Farm I received a number of inquiries on this insect and its remedial measures. While on my trip to the States to the south, I made special inquiries on the varieties of Tent Caterpillars common to the Pacific Coast States, and was informed that together with a species that corresponds directly to the Eastern Orchard pest, which is to be found throughout the West, there are at least three species native to the Pacific Coast States, viz., *Malacosoma erosa, M. pluvialis, M. constricta.* The first two feed upon almost everything in the orchard but the pear, which under normal conditions seems immune. *Constricta* devastates the Oak, sometimes attacking the Prune. *Erosa,* so far as I could gather, in a general way, is confined to the territory west of the Cascade Range of mountains, whereas *pluvialis* is to be commonly found in the interior.

The Kootenay District this year was visited by a species of climbing cutworm, which caused the growers considerable worry (from my reference) in the Nelson District. Passing through this District early in September, my attention was drawn by Mr. Morrice Middleton the Assistant Provincial Horticulturalist for that District, to the destruction of a number of young newly-set apple trees by the effects of the Paris green in the poisoned bran mixture, which mixture he had recommended to control the cutworms. The growers had made the mixture of the usual strength, but had thrown it up around the butts of the trees, which, from the action of the arsenic, by the middle of summer became completely girdled. I saw an orchard of som e 200 odd trees in which fully 45 had suffered in this way, and the owner was complaining that no reference was to be found in any of his books of reference on the possible effects of Paris green.

Several inquiries came to hand on the subject of beetles which attack the buds and blossoms of the young apple trees. The insects proved in most cases to be the adults of Elater beetles, and several species are involved. Mr. Venables, of Vernon, reports Corymbites inflatus as destructive in the Okanagan District. In the Lower Fraser Valley, I noticed elater beetles devouring the blossoms, including the calyx cups, the pistils and stamens, and also observed occasions where buds were

taken off, presumably also due to these beetles. Young developing leaves were also fed upon and maturing apples also suffered by the beetles eating portions of the epidermis and pulp. I took some of these beetles with me to the Oregon Agricultural College and identified one beetle with the collection in the Entomological Division as *Ludius suckleyi.* Another species I had in hand I could not be sure of but it resembled closely *Limonius discoideus,* a species which in Oregon affects the buds and the blossoms in the same way.

A report came to me through Mr. W. H. Brittain, Provincial Entomologist and Plant Pathologist, at Vernon, mentioning species of weevils which affect apple buds in the Okanagan. I understand that in Washington State, as well as in Oregon, bud weevils are important factors to be guarded against.

A letter with an enclosure of some apple twigs was forwarded to me from the Agassiz Experimental Farm as coming from Yahk, B.C., a place almost on the border line of British Columbia and Washington State, in the Valley of the Columbia River. The insect contained was dead, but that as it was lepidopterous it might be referable to the injury by the larvæ of the Bud Moth, which at times takes on a boring habit in the petioles of leaves and young twigs of apples.

My attention has been drawn on one or more occasions to the malformations of apples in the Lower Fraser Valley. The fruit on the tree would be nearly full grown, but a certain number would have remained small, deformed, and very "lumpy." There would often be a cluster of apples showing this appearance, as if they had not developed for lack of proper nourishment. I was at a loss to know the reason for this in so far as no insect could be found, neither did the "lumps" show any appearance of insect sting or feeding punctures. While in Oregon, Mr. H. F. Wilson, Assistant Entomologist at the Corvallis Station, drew my attention to apples in the college orchard there showing what appeared to me to be the similar injuries as those on the apples in the Lower Fraser Valley. He was making a special study of the insects which caused these malformations and said it was due to the Rosy Apple Aphis, (*Aphis sorbi*), an insect which is the most serious apple aphis pest in Oregon—The Woolly and the Green Aphis being present.

Aphis sorbi passes the winter and spring on the tree, migrating to some unknown host plant during the summer, returning in due course to the apple tree in the fall.

In the Fraser Valley the Woolly Aphis (*Eriosoma lanigera*) is to be found in nearly every orchard, but its presence has not attracted very marked attention on the part of the growers. The Oyster Shell Scale is a serious pest when left alone and not sprayed. It seems more abundant on the Coast region than in the interior. The combined action of this scale and the Tent Caterpillar has succeeded in killing a large number of the wild crab apple trees on the Coast, a fact that is not deplored.

In the very early spring a small black weevil, *Magdalis aenescens,* may commonly be seen in the orchards of the Lower Fraser Valley. But its attacks are restricted to dead bark tissues, particularly in association with the fungous known locally as the Black Spot Canker.

Syneta albida is a small whitish beetle commonly occurring in the spring on apple trees in the Fraser Valley. It is reported as devouring portions of the exterior of the fruit of young developing apples and maturing cherries.

The *San José Scale,* so far as is known, is not found in British Columbia. An occasional outbreak in the past has been reported, but to-day the country is believed

to be free from this pest. It is common in the State of Washington and is gradually extending up the Okanagan Valley in the State of Washington. It can only be a question of time that this pest will be found to occur in the orchards of British Columbia, particularly in the Okanagan. We cannot hope for immunity from this pest for all time, consequently from now on the growers in the lower portion of the British Columbia Okanagan Valley will have to keep a sharp lookout for its appearance, and when and where it does appear to subject it to immediate remedial measures.

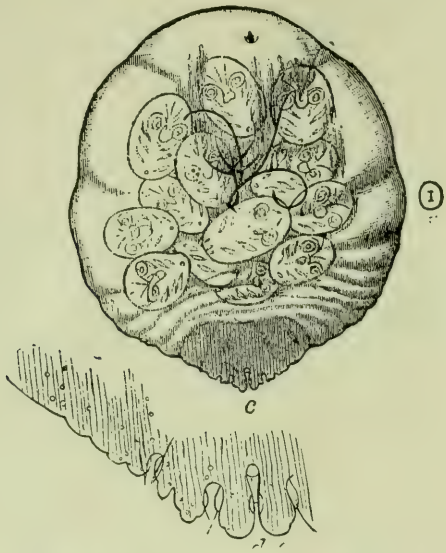

Fig. 42.—San José Scale. Female scale with young.

The Codling Moth is an insect of the same nature which also is gradually extending up the Valley of the Okanagan. It is closer to the British Columbia line than the San José Scale, but as yet it is not reported in the British Columbia territory of that district. Mr. W. H. Brittain, however, found an isolated centre of infestation at Armstrong, a point north of the Okanagan Lake, this summer. Mr. Thos. Cunningham, the Provincial Inspector of Fruit Pests, promptly dealt with it by collecting all the apples in the locality and boiling them in a large vat. This action is to be highly commended as it delays as much as possible the day of general infestation in the Province.

There seems little doubt, however, that the day is not very far distant when the Codling Moth, like the San José Scale, will be present in the British Columbia orchards, and it may reasonably be first expected in the Okanagan, for as soon as the young orchards in the Okanagan Valley south of the British Columbia border line come into bearing, their infestation is merely a question of time, and this in due course leads to the bearing orchard land in the southern portion of the British Columbia Okanagan District. The Okanagan Valley lying east of the Cascade Range is the channel along which the prevailing winds travel and the birds migrate.

In my brief stay in the Okanagan I found the orchard mites *Bryobia* and *Tetranychus* of economic importance. They are present also in the Lower Fraser Valley, but the dry climate of the interior seems to be more favaroble to the growth and reproduction.

The Pear Tree Blister Mite was found to occur in every orchard in the Fraser Valley similarly so with the Pear Tree Slug. The latter is two brooded. The first brood this year did not appear in such numbers as to cause any material loss. The second brood appeared to be more plentiful in point of numbers, but it occurred late enough not to injure the trees, merely assisting nature to ripen the wood. *Myzus cerasi* and the Green Apple Aphis also occurred in the Fraser Valley but I saw no instance on mature trees where their presence was causing material harm. In this country where the seasons are long and the growth luxuriant, insects of this nature tend to check the excessive growth, and unless present in too great numbers act almost as a beneficent agency.

An insect which for the time being is called the Lesser Apple Worm can generally be found at apple picking time occurring lightly in most orchards in the Fraser Valley. It appears to affect the Crab, Spy, Gravenstein, and King apples in particular. I have not bred this insect to the adult yet, so cannot be sure it is the same insect as occurs in a similar way in the Eastern orchards. I am hoping to bring some of these insects through the winter and work on their life history next summer.

Small Fruit Insects.

In the Lower Fraser Valley, which is pre-eminently a small fruit and truck gardening district, the one serious pest in proportion to the injury is the Strawberry Root Weevil, *Otiorhynchus ovatus*. The larvae girdle the roots of the plants, causing death either by malnutrition or by exposing the plants to the drying action of sun and wind, for the deeper roots are taken off as a rule previous to the surface roots, consequently the whole root surface is forced nearer the ground surface. As a rule plantations do not suffer until the spring of the second year from planting, although I was informed locally that occasions have arisen whereby the infestation was so severe that plantations had to be plowed up previous to taking the first crop and sometimes just after the first crop was picked. Such cases are, I would fancy, the exception and not the rule, and some peculiar local dependent conditions must have been present. I have paid particular attention to the biology of this weevil this summer and am preparing a much longer and detailed report on its habits, but the general points in its life history are somewhat as follows. My notes only extend over this season, so due allowance must be made until duplicate notes are obtained next year or succeeding years.

The egg-laying period in the field began about June 15th and extended till August 22nd. The egg stage per individual laster 22-24 days. The larvae began to hatch about July 15th and continued to hatch until September 14th. The great majority of the larvae pass the winter in the half-grown larval state and emerge as the adult in the middle of June and continue emerging until the first part of July. The pupal stage like the egg stage lasts about three weeks. There is only two weeks in the year when the ground may be presumably free from the presence of larvae and that is the early part of July. I have no records of date of a second brood. The list of its food plants is a very long one, and while it has shown itself particularly fond of strawberry roots, I believe its primary food is the roots of grasses. I have taken the larvae of the weevil feeding indiscriminately upon roots of weeds and strawberries intermingling in the strawberry row.

The most satisfactory remedy that can be devised to date, when the acreage is available, is fall plowing and rotation of crops. But the unfortunate part of it is that the farms are so small, 5-10 acres, for the most part where this insect occurs

that even if rotation is individually practised it practically amounts to growing strawberries year by year on the same piece of ground. The best remedy for preventing infestation that can be suggested at present on these small farms, where the weevils have become concentrated, is to stop the production of strawberries for a year or two, cultivating the ground frequently, allowing chickens free range in the infested patch, and then when reasonably sure that the ground is clean to evolve a system entailing a barricade against the weevil which from the structure of its wing covers cannot fly and is doomed to walk the earth. A wooden boarding with an overlap of tin on the under surface of which is placed some sticky material such as "Tree Tanglefoot" might be employed to advantage on a small farm. The framework could be made permanent and by the annual application of some sticky material for two months in the summer it might be made the means of keeping a great majority of the weevils out. One grower, near Portland, Oregon, was practising some such scheme as this, using tar or some mixture with tar on his tin, but I do not think it proved entirely successful. The principle is still an experiment both as regards efficiency and cost of maintenance.

The cheapest and most efficient mixture experimented with this summer to be used on the barricade was a mixture of resin gum and boiled oil in a proportion of 3 to 1. This mixture must be applied direct to the tin surface and not to the wood, for the wood absorbs the oil and the plan quickly becomes worthless. Commercial Tanglefoot will give good results, provided every care is given the question of preventing rain splashing up on to its surface. Rain-splashed it soon becomes worthless, but protected, and even on a wood surface, its holds its efficiency, most of the summer, on a single application. Its price might prove prohibitory to the general grower.

Unless some such plan like this is devised it seems little use growing strawberries two years in succession on a small acre farm, for the profit to the acre is liable to be so reduced that it is hardly worth while growing the plants. I should assume that not much more than one acre in ten should be planted to strawberries in a weevil infested district, perhaps then a system of rotation could be arranged with the neighboring farmers if they were all interested in the same way.

Another insect reported to me by correspondence from Grand Prairie, B.C., is the Currant Fruit Miner (*Epochra canadensis*), which is present throughout the Western states and British Columbia, and where Currants and Gooseberries are being grown is a decided pest, the worst of its kind for the fruits it attacks.

The Current Borer (*Aegeria tipuliformis*) is another pest which would assume large proportions if the crop was more planted. It is commonly to be found in the Lower Fraser Valley.

Truck Crops.

Fully 75 per cent. of the enquiries at the Agassiz Experimental Farm have been in connection with the Cabbage Maggot. I have invariably replied giving the Carbolic Acid Emulsion as a remedy and the Tarred Discs. On two occasions reports were returned that the Carbolic solution had given good results when applied early. The truck gardeners around Vancouver suffer severely from this class of insect.

I have also received a report, with specimens enclosed, of the larvae of some elater beetle—wireworms—from Mission, which were working on the tubers of potatoes in the ground. The potatoes on being dug were found to have these "worms" inside.

In connection with Potato insects I would like to draw attention to the approach of the Colorado Potato Beetle (*Leptinotarsa decemlineata*) to the boundaries of British Columbia. Some ten years ago this beetle became imported and localized near a place called Nez Percé, in Idaho. It has now extended its territory into Washington, so much so that the south-east corner of the state is generally affected. An isolated report was received by Professor Melander, of Pullman, by correspondence this summer describing an insect which left little doubt of its nature on the presence of this beetle at a place called Metaline Falls, a point some ten odd miles south of the British Columbia border line, in the Columbia River Valley, opening into the Lower Kootenay country. If this report is correct we may expect to receive reports of its presence in British Columbia in the near future, at any rate it is in the same class as the Codling Moth and the San Jose Scale and may be expected in the course of years under natural conditions.

Except for another outbreak of the Californian Tortoiseshell butterfly (*Vanessa californica*), in the Kootenay country, confining its depredations to the bush and cultivated places, this about completes the record of my British Columbia notes on insects occurring during the past six months. I hope in a few days to make out my report on these same insects as mentioned much more fully and explanatory.

ARSENITE OF ZINC AS A SUBSTITUTE FOR ARSENATE OF LEAD.

L. Caesar, B.A., B.S.A., Guelph.

Arsenite of Zinc is a very fine whitish, fluffy powder, much lighter than Paris Green. It contains approximately forty per cent. of arsenious acid, which is about three times as much as Arsenate of Lead contains. It costs twenty cents a pound f.o.b. and is manufactured by the California Chemical Spray Co., Watsonville, California. For some years this company has been testing the value of Arsenite of Zinc, and claims that the results have been highly satisfactory. Prof. Melander, of Pullman, Washington, in limited tests states that it gave excellent results against Codling Moth†. Prof. Cooley, of Montana Agricultural Experiment Station, says that in his experiments it controlled Potato Beetles as well as Paris Green did, and that it is a very stable compound, no arsenical injury taking place to the crown or bark of trees, even when wounds were made and bandages kept moist with the mixture were applied. Arsenate of Lead and all other arsenicals tested caused more or less injury when thus used.*

Statements like these led me to make some tests at Guelph this year, and to urge other parties in various parts of the province to co-operate so that a comparison of results might give some valuable information.

The first test was for Codling Moth. Alternate trees in two old orchards were sprayed with Arsenite of Zinc and Arsenate of Lead. A little over 1 lb. of the the former to 40 gallons of dilute lime-sulphur (1.008 sp. gr.) was used and 3 lbs. of the latter to the same amount and strength of lime-sulphur. In my absence my colleague, Mr. A. W. Baker, did the spraying and took the necessary pains to see that it was thorough. Examinations of the trees at various times throughout the season showed that while both mixtures gave excellent results the trees sprayed with Arsenite of Zinc were a little cleaner than the others, only very rarely an apple being wormy. Unsprayed trees had much wormy fruit.

Mr. Beckett, an extensive grower of apples at Hamilton, and Mr. J. E. Smith, of Simcoe, co-operated in tests against the Codling Moth with Arsenite of Zinc. The

†Bulletin No. 103, Agr. Expt. Sta. Pullman, Washington.
*Journal of Econ. Ent., Vol. 5, No. 2.

former used 100 lbs. of the poison and reported that in his opinion it was quite as satisfactory as Arsenate of Lead; the latter said that he was also pleased with the results, but did not think his tests sufficiently extensive to draw reliable conclusions.

My second test was against Potato Beetles. Mr. G. J. Spencer conducted this for me. On one plot he used 1 lb. Arsenite of Zinc to 40 gallons Bordeaux mixture, and on another 3 lbs. Arsenate of Lead to the same amount of Bordeaux. Both poisons destroyed all the beetles, so that perfectly satisfactory results were obtained.

In no case, whether combined with the lime-sulphur or with Bordeaux, did we see any evidence of burning; moreover, the fungicidal value of the lime-sulphur did not seem to have been lessened, because even the Snow apples that were sprayed were almost entirely free from Scab, quite as free as those sprayed with Arsenate of Lead and lime-sulphur. As the potatoes were early varieties and ripened before there was any injury from Blight we cannot speak of the effect from this disease, so destructive this year to late potatoes.

The result of this year's experiments would therefore go to show that Arsenite of Zinc may prove to be a very excellent and safe insecticide and may even supersede Arsenate of Lead, especially as, apart from its poisoning merits, it has several advantages over the latter:—

(1) It can be easily stored, being a powder, whereas Arsenate of Lead is a paste and should not be allowed to freeze or dry out.

(2) It takes less time to prepare for the tank, all that is necessary being to mix up the desired amount in a pail with a little water and then pour it into the tank, whereas Arsenate of Lead, being a paste, takes a good deal of stirring in water to bring it into suspension.

(3) It can be manufactured more cheaply than Arsenate of Lead; one pound costing 20 cents, but each pound contains as much arsenious acid as about three pounds of Arsenate of Lead, and therefore is equivalent in killing power to that amount. As Arsenate of Lead costs at least 10 cents a pound, an equal strength of Arsenite of Zinc would cost only two-thirds this amount.

(4) When used alone in water we found that it remained in suspension considerably longer than Arsenate of Lead, this being due probably to the greater fineness of the particles of which it is composed. When added to lime-sulphur this advantage was lost as it settled somewhat rapidly, thus indicating that constant agitations would be necessary. In sticking qualities it is apparently slightly inferior to Arsenate of Lead.

Whether any chemical action takes place when it is added to lime-sulphur is difficult to determine for certain, as in tests made by the chemists very little if any change could be detected.

Although this season's work has given me a very favorable opinion of Arsenite of Zinc, I should not care to recommend anyone to use it except experimentally for a year or two yet until we see how it will act under different conditions of moisture and temperature. In conversation with some men from the United States I was told that they had heard that the results there this year were not satisfactory. Whether this be correct or not, it is probable that the insecticide has been tested in many states and reports should soon begin to come in. These reports ought to give us information as to the real value of Arsenite of Zinc. Should it prove to be very satisfactory, there is little doubt that it would soon be manufactured in many parts of the United States and Canada, so that it could be procured without the present high cost for freight or express.

THE ENTOMOLOGICAL RECORD, 1912.

ARTHUR GIBSON, CHIEF ASSISTANT ENTOMOLOGIST, DIVISION OF ENTOMOLOGY, OTTAWA.

In general throughout Canada the climatic conditions of 1912 were not favourable for the collection of insects. In eastern Ontario and throughout Quebec the weather during the summer months was disappointing, being cool with much rain. In the Ottawa district practically the only warm, clear weather in the whole season was in the first two weeks of July. At Chelsea, Que., in the Gatineau hills, near Ottawa, where I had a cottage for the season, the evenings with few exceptions were decidedly cool, and unless well clad it was almost impossible to sit out on the verandah with any degree of comfort. Night after night I "sugared" nearby trees for noctuids, but seldom saw more than two or three specimens on a tree during a whole evening. Similar statements indicating, on the whole, a "poor collecting season" were received from collectors in various parts of the Dominion.

During the year several important expeditions were made to various parts of Canada by well known naturalists, and many specimens of insects were collected for study by specialists in the United States. Prof. R. C. Osburn, of Columbia University, New York, spent a part of the summer in collecting in British Columbia, particularly at Kaslo, Glacier and in the Yoho Valley, near Field. Messrs. Riley and Hollister, of the United States National Museum, collected at many points in western Canada; Mr. H. T. Cleaves, of the Public Museum of the Staten Island Association of Arts and Sciences, New Brighton, N.Y., visited Nova Scotia, collecting chiefly in the vicinity of South Deerfield and Lake George, also on Seal Island; Mr. D. H. Nelles, of the Dominion Alaska Boundary Survey, brought back several small collections, mostly made near Rampart House, Y.T. Mr. Nelles informs me that Mr. J. M. Jessop, while engaged in geological work for the U.S. Government, along the 141st Meridian, between the Porcupine River and the Arctic Ocean, made large collections of lepidoptera and coleoptera.

We have again to gratefully acknowledge the invaluable help received from recognized authorities in the United States and elsewhere. Particular acknowledgement is due to Dr. L. O. Howard and his expert associates, Dr. Dyar, Dr. Banks, Messrs. Schwarz, Busck, Crawford, Viereck, Rohwer, and Knab; Sir George Hampson of the British Museum; Mr. W. D. Kearfott, of Montclair, N.J.; Prof. H. F. Wickham, of Iowa City, Iowa; Mr. E. P. Van Duzee, of Buffalo, N.Y.; Mr. W. Beutenmuller and Mr. J. A. Grossbeck, of New York, N.Y.; Dr. Henry Skinner, of Philadelphia, Pa.; Dr. E. M. Walker, of Toronto, Ont.; Col. Thos. L. Casey, of Washington, D.C.; C. W. Johnston, Boston, Mass.; Mr. Chas. Liebeck, of Philadelphia, Pa.; Mr. J. D. Evans, of Trenton, Ont.; Mr. F. H. Wolley-Dod, of Millarville, Alta.; Prof. Cockerell, of Boulder, Col.; Prof. J. S. Hine, of Columbus, Ohio; and Dr. W. G. Dietz, of Hazleton, Pa.

LITERATURE.

Among the many valuable publications which have been received during 1912, and which are of interest to Canadian students, mention may be made of the following:—

BARNES, W., and MCDUNNOUGH, J. H. Contributions to the Natural History of the Lepidoptera of North America: Decatur, Ill. (to be obtained from Dr. William Barnes). Vol. I., No. 1—Revision of the Cossidae, 35 pp., 7 plates, price 8 E.S.

$1.50; Vol. I., No. 2—The Lasiocampid genera Gloveria and its Allies, 17 pp., 4 plates, price $1.00; Vol. I., No. 3—Revision of the Megathymidae, 43 pp., 6 plates, price $1.25; Vol. I., No. 4—Illustrations of Rare and Typical Lepidoptera, 57 pp., 27 plates, price $3.50; Vol. I., No. 5—Fifty New Species: Notes on the Genus Alpheias, 44 pp., 5 plates, price $1.50; Vol. 1, No. 6—On the Generic Types of North American Diurnal Lepidoptera, 13 pp., price 50c. These important contributions are very welcome and we sincerely hope they are but a beginning to many which the authors will prepare. The illustrations are excellent.

Casey, Thos. L. Memoirs on the Coleoptera, III.; New Era Printing Co., Lancaster, Pa., issued March 20, 1912. This memoir of 386 pages consists of three parts: I.—Descriptive Catalogue of the American Byrrhidæ; II.—A Revision of the American Genera of the Tenebrionid Tribe Asidini, and III.—Studies in the Longicornia of North America. In the first paper 58 Byrrhids are described as new; of these, 15 are from Canada. In the revision of the Asidini, 133 are described as new species and 30 as new subspecies. None of these are from Canada. In Part III. the descriptions of 172 new species and 40 new subspecies are given; of these, five species and one subspecies are from Canada.

Cockerell, T. D. A. Names Applied to Bees of the Genus Osmia, found in North America: Proc. U. S. N. M., Vol. 42, pp. 215-225; separates published April 13, 1912. In this list 167 names are given, 60 of which are represented by specimens in the collections of the U. S. N. M.; of these 60, 22 are types or paratypes. In each case the type, locality, and collector of the type is given, if known. Many brief descriptive notes are also given. This paper will be a useful one.

Cockerell, T. D. A. Names Applied to the Eucerine Bees of North America: Proc. U. S. N. M., Vol. 43, pp. 261-273; separates published Oct. 19, 1912. The previous catalogue of the North American Eucerines appeared in the Transactions of the American Entomological Society, Vol. 32, 1906. Since, numerous species have been added and a few changes in nomenclature made. The present list gives the type localities, and names of collectors of the types when known. There are also references to the principal synoptic tables. Students of the Hymenoptera will welcome this new catalogue.

Comstock, J. H. The Spider Book—A Manual for the Study of the Spiders and Their Near Relatives, The Scorpions, Pseudoscorpions, Whipscorpions, Harvestmen, and Other Members of the Class Arachnida, found in America North of Mexico, with Analytical Keys for their Classification and Popular Accounts of their Habits: New York; Doubleday, Page and Co., 1912, pp. xv. + 707, 771 figs.; price $4.00. This companion book to The Butterfly Book, The Moth Book, The Insect Book, and the other extremely useful nature books published by the above firm will be eagerly welcomed by entomologists. The systematic descriptions of the genera and species, and particularly the keys for their identification are specially valuable. The illustrations throughout the book are excellent. Now that such a reliable volume is obtainable we hope to see a much wider interest taken, in Canada, in these interesting creatures. To the author we extend our best congratulations on the completion, in such a beautiful form of his years of work on spiders.

Cosens, A. A Contribution to the Morphology and Biology of Insect Galls: Reprinted from the Transactions of the Canadian Institute, Vol. IX., 1912; University Press, Toronto; pp. 297-387, plates I.-XIII. The results of the studies communicated in this contribution are most valuable. Much original matter is presented. Students of insect galls will welcome this important addition to the literature.

JOHANNSEN, O. A. The Mycetophilidæ of North America: Maine Agri. Exp. Station, Bull. No. 196 (Dec. 1911, first copies mailed March 8, 1912), Part III.—The Mycetophilinæ, pp. 249-328, plates 5; Bull. No. 200 (June 1912, first copies mailed July 2, 1912), Part IV.—(conclusion), pp. 57-146, plates 7. In this latter part the species of the genera of the Mycetophilinæ not characterized in Part III. are described, as well as the species of the sub-family Sciarinæ. In these parts eight new species are described from Canada. These bulletins on the Fungus Gnats of North America are important contributions.

HAMPSON, SIR GEORGE F. (Bart.). Catalogue of the Lepidoptera Phalænæ in the British Museum, Vol. XI., Noctuidae, 1912, 689 pp., plates CLXXIV-CXCI., received 17th May, 1912. The subject of this volume is the classification of the subfamilies Eutelianæ, Stictopterinæ, Sarrothripinæ and Acontianæ; 941 species are included belonging to 150 genera. "The four subfamilies are modifications of the great quadrifid section of the noctuidae and are almost confined to the tropical and warmer temperate regions, few genera and species extending to the colder zones and none to the Arctic and Alpine zones." Records of thirty-one species from North America are given in the volume, eight of which are from Canada.

HOOKER, CHARLES W. The Ichneumon Flies of America belonging to the Tribe Ophionini; Trans. Amer. Ent. Soc. XXXVIII Nos. 1 and 2, pp. 1-176, plates I-III, received 22 June, 1912. In the opening chapters, External Anatomy, Variation, Abnormalities, Geological History, Life History and Habits, Economic Importance Disease and Natural Enemies are briefly discussed. In the study of the tribe, the author has examined all but four of the types existing in America, so far as known. Seven of the North American species are stated to occur in Canada. This monographic treatment of the Ophionini is an important contribution, and one which will be of particular value to economic entomologists.

KRÖBER, O. Die Therviden Nordamerikas: Stettiner Entomologische Zeitung, 73, Jahrgang, Heft II; received Dec. 23, 1912. In this paper, pages 209-272, the author confines himself to a thorough discussion of the species before him. Nine genera are included, full descriptions being given of 36 species; nine of the latter are described as new, one of which is from Canada.

MALLOCH, J. R. The Insects of the Dipterous Family Phoridæ in the United States National Musemum; Proc. U. S. N. M., Vol. 43, pp. 411-529, with plates 35-41, published Dec. 14, 1912. In this paper many species are described as new, eleven of which are from Canada. Little is known about the larval habits of these insects. This contribution is an important one and we hope it will lead to studies in the life-histories of the species. The plates show structural characters.

O'KANE, W. C. Injurious Insects; How to Recognize and Control them, illustrated with 600 original photographs. New York: The MacMillan Company; published November, 1912, 414 pages, price $2.00. This new reference book on insect pests will be found of value to farmers, fruit-growers, market gardeners, in fact, anyone interested in any branch of agriculture. It is profusely illustrated.

PERRIN, JOSEPH AND RUSSELL, JOHN. Catalogue of Butterflies and Moths collected in the neighborhood of Halifax and Digby, N. S.: Transactions of the Nova Scotian Institute of Science, Vol. XII, part 3, pp. 258-290; Halifax, author's separates published 8 Feby., 1912. This is a very useful list. 530 species and varieties are included, 60 of butterflies and 470 moths. Few records of species in the families following the geometridae in Dyar's Catalogue are included, and when further systematic collecting is done, particularly in the microlepidoptera, the list will be materially added to.

SANDERSON, E. DWIGHT, AND JACKSON, C. F., Elementary Entomology, 372 pages, 496 figs.: Ginn & Co., Boston, New York, Chicago, London; price $2.00. This new elementary text book, which although, as the authors state, is largely a compilation from the works of others, will undoubtedly receive the welcome it deserves. It is divided into three parts, viz.; Part I—The Structure and Growth of Insects, Part II—The Classes of Insects, Parts III—Laboratory Exercises. The senior author is responsible for Parts I and II, and the junior author for Part III.

SANDERSON, E. DWIGHT. Insect Pests of Farm, Orchard and Garden, 684 pages, 513 illustrations: New York, John Wiley & Sons, also the Renouf Publishing Co., Montreal, price $3.00. In this useful book, the author discusses the more important insect pests of the farm, orchard and garden. The work will be of special value to those working in economic entomology, and of course to the practical farmer, fruit-grower, or gardener. Any one interested in insect life, however, will find the volume a valuable source of reference.

WALKER, E. M. The North American Dragonflies of the Genus Aeshna: University of Toronto Studies, Biological Series No. 11. The University Library: Published by the Librarian, 1912, (received May 2, 1912). This monographic treatment, of 213 pages, of the North American Dragonflies of the above genus, is an extremely important contribution. The genus is considered in its narrowest sense, the species separated from it by Williamson under the names Coryphæschna being excluded. Taxonomic characters are discussed on pages 4 to 25; variations on pages 25-30 and General Life-history on pages 30-56. Pages 56-202 are taken up in a systematic treatment of the species. Keys are given for the identification of the males and the females. The keys are followed with full descriptions of the species, distributions, etc. Pages 203-213 give a list of the literature cited. The volume closes with a series of magnificent plates, Nos. 1 to 28, reproduced from the author's own drawings. The cost of the plates was generously met by Sir Edmund Walker, Chairman of the Board of Governors of the University. Entomologists generally will welcome this valuable publication.

WICKHAM, H. F. AND WOLCOTT, A. B. Notes on Cleridæ from North and Central America; Bulletin of the State University of Iowa, Vol. VI, No. 3, pp. 49-67. This paper is a catalogue of the species of cleridæ contained in the collection of the senior author and is intended as a contribution to the exact knowledge of the distribution of the species of the family on the North American continent. Three new species and two new varieties described. Many Canadian records are given.

WINN, ALBERT F. A Preliminary List of the Insects of the Province of Quebec, Part I, Lepidoptera. Published as a supplement to Report of the Quebec Society for the Protection of Plants, 1912. This very useful list of 103 pages has recently been received. The arrangement of the order is similar to that adopted by Smith in his 1909 edition of the Insects of New Jersey. Before each family a brief account of the chief characters are given, and under each species all localities known to the author within the Province are mentioned, together with the month in which the species was met with. The name of the collector is indicated by an abbreviation explained in the opening chapter. This list will prove of much value not only to lepidopterists within the Province of Quebec, but to all others interested in North American species. Our hearty congratulations are extended to the compiler, to the Society in its work in connection with the list, and to the Quebec Government for its aid in having the list printed. We hope that other parts will appear soon. If an index were added to the next part published it would add very much to its value.

The following is a list of the names and addresses of collectors heard from during 1912:—

Anderson, E. M., Provincial Museum, Victoria, B.C.
Baird, Thomas, High River, Alta.
Beaulieu, G., Experimental Farm, Ottawa.
Beaulne, J. I., Experimental Farm, Ottawa.
Bethune, Rev. Prof., O. A. C., Guelph.
Boulton, A. R. M., Quebec, Que.
Brittain, W., Vernon, B.C.
Bush, A. H., 1105 Ninth Ave., Vancouver, B.C.
Chagnon, Gus., Box 521, Montreal.
Chagnon, W., St. Johns, Que.
Cockle, J. W., Kaslo, B.C.
Crew, R. J., 561 Carlaw Ave., Toronto.
Criddle, Norman, Treesbank, Man.
Dawson, Horace, Hymers, Ont.
Day, G. O., Duncans, B.C.
Dod, F. H. Wolley, Midnapore, Alta.
Evans, J. D., Trenton, Ont.
Fyles, Rev. T. W., 368 Frank St., Ottawa.
Germain, Rev. Bro., 125 Empress St., Ottawa.
Gibson, Arthur, Experimental Farm, Ottawa.
Hahn, Paul, 433 Indian Road, Toronto.
Haight, D. H., Sudbury, Ont.
Hanham, A. W., Duncans, B.C.
Harms, J. F., Treesbank, Man.
Harrington, W. H., P. O. Department, Ottawa.
Heath, E. F., Cartwright, Man.
Hewitt, Dr. C. Gordon, Experimental Farm, Ottawa.
Hoyler, Rev. Clement, Dundurn, Sask.
Hudson, A. F., Millarville, Alta.
Hudson, H. F., Strathroy, Ont.
Keen, Rev. J. H., Metlakatla, B.C.
Leavitt, A. G., St. John, N.B.
Lyman, H. H., 74 McTavish Street, Montreal.
McIntosh, W., St. John, N.B.
Mignault, Rev. J. B., St. Therese, Que.
Moore, G. A., 850 St. Hubert St., Montreal.
Moore, W. H., Scotch Lake, N.B.
Metcalfe, W., 284 Lisgar St., Ottawa.
Nelles, Douglas H., Dept. Interior, Ottawa.
Nicholls, Arch., Sault Ste. Marie, Ont.
Perrin, Jos., McNab's Island, Halifax, N.S.
Richard, Rev. A. E., Perkins, Que.
Sanders, G. E., Bridgetown, N.S.
Sanson, N. B., Banff, Alta.
Simpson, W., Dominion Observatory, Ottawa.
Sladen, F. W. L., Experimental Farm, Ottawa.

Swaine, J. M., Experimental Farm, Ottawa.
Tothill, J. D., Fredericton, N.B.
Treherne, R. C., Agassiz, B.C.
Venables, E. P., Vernon, B.C.
Walker, Dr. E. M., Univ. of Toronto, Toronto
Wallis, J. B., Machray School, Winnipeg, Man.
Willing, Prof. T. N., Univ. of Saskatchewan, Saskatoon, Sask.
Winn, A. F., 32 Springfield Ave., Westmount, Que.
Young, C. H., Victoria Memorial Museum, Ottawa.

NOTES OF CAPTURES.

(Species preceded by an asterisk (*) described during 1912.)

Lepidoptera.

(Arranged according to Dyar's List of North American Lepidoptera, U.S. N.M. Bull. No. 52).

(Dyar's number).

41. *Nathalis iole* Bdv. Winnipeg, Man., Sept. 4, 1 specimen, quite fresh, (Wallis).

Argynnis sakuntala Skinner. Entered in last year's Record. This form is the one recorded in the Alberta list as "*monticola* Behr?" Can. Ent., XL., 151, May, 1908, (Dod).

216. *Eugonia californica* Bdv. Banff, Alta.; last year this species was more or less abundant in Sept. I had never noticed or taken it before; several again this year, (Sanson); common in late fall of 1911; fresh looking specimens were seen in spring of 1912, but I saw no sign of the species this fall (1912)—Hanham.

284. *Coenonympha typhon laidon* Bork. Perkins, Que., locally abundant for about a month; last specimen seen on July 13, (Richard).

371. *Incisalia augustus* Kirby. Byron, Ont., May 16, 1908, (J. A. Morden).

555. *Limochroes bimacula* G. & R. The record on page 97 of Report for 1905 should have been credited to J. A. Morden. Since, the species has again been collected at London, on July 1.

559. *Limochroes dion* Edw. Hyde Park Corner, near London, Ont., July 20, 1909, (J. A. Morden).

728. *Marumba modesta* Harris, form *occidentalis* Hy. Edw. Banff, Alta., June 12, (Sanson); Lethbridge, Alta., June, (Miss L. Bentley).

847. *Turuptiana permaculata* Pack. Lethbridge, Alta., July 12, (Miss. L. Bentley).

853. *Estigmene prima* Slosson. Halifax, N.S., June 9, (Perrin).

872. *Hyphoraia parthenos* Harris. Banff, Alta., June 24, (Sanson).

960. *Panthea acronyctoides* Walk. MacNab's Island, Halifax, N.S., June 15, (Perrin).

1008. *Apatela funeralis* Grt. Husavick, Man., 6 specimens, June 22, (Criddle and Wallis).

Apatela tristis Smith. Winnipeg, Man., June 17, 1910; Husavick, Man., June 22, 1912, two females, (Wallis). This form was included in the original material to which the name *inclara* was given by Smith, that is, the series referred to under *hamamelis* in Smith and Dyar's Monograph. It is probably the very form which caused the confusion of the series with true *hamamelis* Guen.=*afflicta* Grt., which it resembles very closely in colour. Plate xii., fig. 12, of the monograph is most likely *tristis*, (Dod).

1053. *Harrisimemna trisignata* Walk. Winnipeg, Man., June 13, 1 specimen at light; new, I think, to Manitoba, (Wallis)

1097. *Platyperigea praeacuta* Smith. Peachland, B.C., Aug., 10, (Wallis).

1109. *Caradrina miranda* Grt. Duncan's, B.C., May, first record for this locality (Hanham).

1151. *Hadena violacea* Grt. Clayoquot, B.C., Aug. 4, 1909, (Anderson).

1199. *Hadena versuta* Smith. St. Therese Island, St. John's Co., Que., July 15, (Chagnon). New to the Quebec list.

1211. *Hadena stipata* Morr. Bridgetown, N.S., Sept. 2, (Sanders).

1215. *Hadena longula* Grt. Peachland, B.C., Aug. 13, (Wallis).

Feralia furtiva Sm. Hymers, Ont., (Dawson).

1331. *Oncocnemis levis* Grt. Lethbridge, Alta., Aug. 23, (Wallis). New to Canada, (Dod).

Oncocnemis laticollis Smith. (Jour. N. Y. Ent. Soc., xvi., 94, June, 1906). Peachland, B.C., Aug. 14, one male (Wallis). Described from Stockton, Utah. The Peachland specimen agrees with specimens from type locality, but is rather more powdery, and has faint indications of median lines, (Dod).

1360. *Oncocnemis regina* Smith. Lethbridge, Alta., Aug. 26, (Wallis). Differs somewhat from type, but if not this species it is indescribed, (Dod).

1391. *Rhynchagrotis brunneicollis* Grt. Aweme, Man., July 29, (Criddle). I can find no previous record for Canada, (Dod).

Aplectoides occidens Hampson. The type of this species is a female in the British Museum labelled "B.C., (Richardo). It formerly stood under *imperita* and was referred to by me under that heading in the Entomological Record for 1910. Another female in my own collection is a co-type, and was taken by Mr. Wallis, at Penticton, B.C., on Aug. 18th, several years ago. I have seen no others. Its nearest ally is *fales* Smith, which I consider an obscure form of *pressa*, (Dod).

1419. *Platagrotis condita* Gn. Husavick, Man., June 22, 23, two males, (Wallis). The name has previously been recorded from Manitoba, but these are the first I have seen like it. They come very close to Hampson's figure but may possibly be distinct. The specimen figured by Hampson is from Montreal, and the species should be added to the Quebec list, (Dod).

1420. *Platagrotis sincera* H.-S. Banff, Alta., Aug. 19, 1909; Aug. 29, Sept. 1 5, 1911, four males at light, (Sanson). I use the name *sincera* tentatively, as it stands in our lists as from Labrador. Staudinger also gives Labrador with several European and Asiatic localities. Hampson

adds "U.S.A., mountains of northern and middle States"; on what authority I know not, as there are no North American specimens in the collection. The Banff form seemed to me to come nearer some specimens under *gelida,* though not to the one Hampson figured as such, (Dod).

Setagrotis filiis Smith. This species which I recorded from Banff previously, turns out to be the *vernilis* of Grote, the *vernilis* of the Kootenai list being apparently another species, (Dod).

1535. *Feltia robustior* Smith. Aweme, Man., Aug. 17, 19, (Criddle).

1553. *Euxoa catenula* Grt.=*contagionis* Smith. Peachland, B.C., Aug. 10, one female, (Wallis). This is the first true *catenula* that I have seen from Canada, the specimen being one of those forms which closely resemble *Porosagrotis vetusta* in colour and some of the markings, thus accounting for the original confusion of the two species. As to structure it has closer allies in *Euxoa* than in *Porosagrotis,* (Dod).

1650. *Euxoa septentrionalis* Walk.=*incubita* Smith. Lethbridge, Alta., Aug. 21, (Wallis). Though the name has previously been recorded, this is the first specimen I have seen from Canada east of the Rockies, that I have been sure of. It resembles specimens from Vancouver Island, where the species is common. It also occurs in California and Arizona. It is quite distinct from *messoria,* (Dod).

1673. *Euxoa recticincta* Smith. Lethbridge, Alta., Aug. 23, 1 at light, (Wallis). The second specimen ever recorded, (Dod).

1693. *Euxoa mollis* Walk. Aweme, Man., July 18, two males, (Criddle).

Anytus derelicta Hampson. Sir George Hampson has thus decided to name the species hitherto passing as *Fishia yosemitae.* I pointed out in Can. Ent. xliii, 398, Dec. 1911, that the species was not *yosemitae,* (Dod).

1788. *Mamestra liquida* Grt. McNab's Island, Halifax, July 14, 1911, (Perrin).

1789. *Mamestra capsularis* Gn. Winnipeg, Man., June 15, 1911, very rare (Wallis).

1894. *Xylomiges dolosa* Grt. Cartwright, Man., 1 specimen, first I have taken, (Heath).

1937. *Anarta secendens* Walk. Banff, Alta., July 25, 1911; June 20, 21, 1912; five males, on electric light poles, (Sanson). The only other specimen I ever saw is the type in the British Museum, from St. Martin's Falls, Hudson Bay territory, with which I have compared a specimen. Hampson places it in the genus *Polia* which he uses as a prior name to *Mamestra,* but it really agrees better with *Anarta* as used by him, and is nearest *richardsoni* in structure. It has broadly black-bordered yellow secondaries, (Dod).

1962. *Heliophila rubripennis* G. & R. Hymers, Ont., (Dawson).

2133. *Cucullia cinderella* Smith. Cartwright, Man., (Heath).

2142. *Rancora solidaginis* Behr. Banff, Alta., Aug. 20, (Sanson).

2148. *Arzama diffusa* Grt. Meach Lake, Que., July 29, 1906, (Young). New to Quebec list.

Hydroecia micacea Esp. Bridgetown, N.S., Oct. 10, (Sanders).

Gortyna pallescens Smith. Lethbridge, Alta., Aug. 26, 1912, (Wallis).

2249. *Glœa sericea* Morr. Meach Lake, Que., Sept. 16, 1903, (Young). New to Quebec list.

2255. *Epiglaea decliva* Grt. Byron, Ont., Oct. 24, 1908, (J. A. Morden).

2259. *Calymnia orina* Gn. Meach Lake, Que., Aug. 8, 1906, (Young). New to Quebec list.

2437. *Cirrophanus triangulifer* Grt. London, Ont., Aug. 18, 1911, (J. A. Morden).

2485. *Autographa biloba* Steph. Winnipeg, Man., June 9, one only; the first specimen taken here since Hanham's capture, (Wallis).

Authographa orophila Hampson. Peachland, B.C., Aug. 10, 1912; Penticton, Aug. 13, 1909, (Wallis).

2556. *Anomis erosa* Hbn. Winnipeg, Man., Sept. 9, 1912, (Wallis).

2847. *Catocala semirelicta* Grt. Husavick, Man., Aug. 21, 1910, (Wallis).

2886. *Catocala coelebs* Grt. Bridgetown, N.S., Sept. 9, (Sanders).

2905. *Catocala gracilis* Edw. Meach Lake, Que., Aug. 6, 1904, (Young). New to Quebec list.

2996. *Homoptera galbanata* Morr. Winnipeg, Man., May and June; recorded as *lineosa* Sm. Hampson refers it to Morrison's species; common at sugar and very variable, (Wallis).

3002. *Homoptera duplicata* Bethune. Winnipeg, Man., 2 specimens, May 24, 28, very rare, (Wallis).

3006. *Erebus odora* L. Banff, Alta., Aug. 13, 1912; a specimen also taken here on Aug. 9, 1910, (Sanson). Mr. J. D. Evans informs me that a fine specimen was taken in the office of the Canada Mines Co., at Trenton, Ont., on Aug. 29.

3007. *Thysania zenobia* Cram. Cartwright, Man., Sept. 5, (Heath).

Eupithecia agnesata Taylor. Kaslo, B.C., one, the second specimen taken, (Cockle).

3337. *Epirrita dilutata* D. & S. Duncan's B. C., Oct. 21, first specimen taken, (Hanham).

3477. *Deptalia insulsaria* Gn. Meach Lake, Que., July 2, 1905; Aug. 18, 1906, (Young). New to Quebec list.

3586. *Chlorosea nevadaria* Pack. Duncan's B.C., one at sugar, July, (Hanham).

3636. *Deilinia liberaria* Walk. Meach Lake, Que., Sept. 6, 1902, (Young). New to Quebec list.

4014. *Sabulodes arcasaria* Walk. Meach Lake, Que., June 10, 1904, (Young). New to Quebec list.

Olene styx B. & McD. Banff, Alta., July 21, 25, 1911, four males, (Sanson). Paler than specimens from Vancouver Island, the type locality, but I think this species, (Dod).

4316. *Diaphania nitidalis* Stoll. Meach Lake, Que., Aug. 11, 1903, (Young). New to Quebec list.

4337. *Crocidophora serratissimalis* Zell. St. John's, Que., June 18, 1911, (W. Chagnon). New to Quebec list.

4411. *Phylctaenia extricalis* Gn. Meach Lake, Que., June 17, 1904, (Young). New to Quebec list.

4496. *Nymphula obliteralis* Walk. St. John's, Que., July, 1911, (G. Chagnon).

4543. *Schoenobius unipunctellus* Rob. St. John's, Que., June 18, 1911, (W. Chagnon). New to Quebec list.

4563. *Crambus pascuellus* Linn. Dawson, Y.T., July 8 to 16. (Record received from Mr. Winn).

4583. *Crambus myellus* Hubn. Meach Lake, Que., July 26, 1907; July 28, 1902; Aug. 3, 1905, (Young). New to Quebec list.

4639. *Epipaschia zelleri* Grt. Aweme, Man., June 1, 1911, reared from Poison Ivy, *Rhus toxicodendron,* (Criddle).

4680. *Myelois corniella* Rag. Meach Lake, Que., July 28, 1905; Aug. 1-5, 1905, (Young). New to Quebec list.

4990. *Pterophorus inquinatus* Zell. Trenton, Ont., Aug. 11, 15, 1911, (Evans).

5006. *Bactra lanceolana* Hubn. Meach Lake, Que., June 19, 23 and 25, 1905, (Young). New to Quebec list.

5007. *Bactra furfurana* Haw. Meach Lake, Que., July 8, 11, 1905, (Young). New to Quebec list.

5020. *Exartema atrodentanum* Fern. St. John's, Que., July 29, 1911, (G. Chagnon). New to Quebec list.

5030. *Olethreutes frigidana* Pack. St. John's, Que., June 22, 1911, (G. Chagnon). New to Quebec list.

5031. *Olethreutes nimbatana* Clem. Bridgetown, N.S., Aug. 9, (Sanders).

5035a. *Olethreutes albeolana* Zell. St. John's Que., June 16, 1911, (G. Chagnon). New to Quebec list.

5038. *Olethreutes hebesana* Walk. Hull, Que., (Gibson). New to Quebec list.

5049. *Olethreutes duplex* Wlsm. St. John's Que., June 18 and 20, 1911, (G. and W. Chagnon). New to Quebec list.

5052. *Olethreutes auricapitana* Walsm. Meach Lake, Que., June 25, 1903; July 18, 1905, (Young). New to Quebec list.

5056. *Olethreutes coruscana* Clem. Trenton, Ont., June 12, 1911, (Evans).

5068. *Olethreutes glaciana* Moschl. Meach Lake, Que., June 14, July 18, 28, 1905, (Young); new to Quebec list; Trenton, Ont., June 11, 18. (Evans).

5078. *Pseudogalleria inimicella* Zell. Montreal, June 4, 1911, (Winn). New to Quebec list.

5121. *Eucosma juncticiliana* Walsm. Meach Lake, Que., July 26, 1903; Aug. 5, 1902, (Young). St. John's, Que., July, 1911, (G. Chagnon). New to Quebec list.

5131. *Eucosma nisella* Clerck. Meach Lake, Que., July 27, Aug. 12, 1905, (Young). New to Quebec list.

5143. *Eucosma similana* Hubn. Meach Lake, Que., Sept. 4, 1904; Aug. 27, 1907, (Young). New to Quebec list.

5167. *Thiodia aspidiscana* Hubn. Meach Lake, Que., June 9, 1905, (Young). New to Quebec list.

5168. *Thiodia ferruginana* Fern. Meach Lake, Que., June 9, 1905, (Young). New to Quebec list.

Epinotia dietziana Kearf. St. John's, Que., June 17, 1911, (G. Chagnon). New to Quebec list.

5235. *Epinotia lindana* Fern. Meach Lake, Que., Sept. 4, 11, 1904, (Young). New to Quebec list.

Ancylis carbonana Kearf. Montreal, May 27, 1911, (Chagnon). New to Quebec list.

5246. *Ancylis spiræifoliana* Clem. Meach Lake, Que., June 7, 1903, (Young). New to Quebec list.

5255. *Ancylis divisana* Walk. Meach Lake, Que., July 8, 1904; June 23, 1905; July 1, 1905, (Young). New to Quebec list.

5261. *Ancylis goodelliana* Fern. Meach Lake, Que., June 9, 1905; Aug. 9, 1905, (Young). New to Quebec list.

5299. *Alceris effractana* Frol. Meach Lake, Que., Aug. 4, 1905, (Young). New to Quebec list.

5309. *Alceris hastiana* Linn. Meach Lake, Que., June 16, 1905; Sept. 16, 25, 1905, (Young). New to Quebec list.

5324. *Alceris americana* Fern. Meach Lake, Que., Sept. 2, 1905, (Young). New to Quebec list.

5381. *Archips dissitana* Grt. Meach Lake, Que., July 23, 1903, (Young); East Bolton, Que., July 20, 1911, (Winn). New to Quebec list.

5407. *Tortrix packardiana* Fern. Meach Lake, Que., June 19, 1903, (Young). New to Quebec list.

5408. *Tortrix conflictana* Walk. Dawson, Y.T. (Record received from Mr. Winn).

5427. *Eulia mariana* Fern. Mt. St. Hilaire, Que., May 14, 1911, (G. Chagnon). New to Quebec list.

5446. *Phalonia argentilimitana* Rob. Meach Lake, Que., July 9, 11, 1905, (Young). New to Quebec list.

5451. *Phalonia interruptofasciata* Rob. St. John's, Que., June 17, 1911, (G. Chagnon). New to Quebec list.

5488. *Periclymenobius canariellus* Walsm. Meach Lake, Que., Aug. 5, 1904, (Young). New to Quebec list.

5519. *Choreutis inflatella* Clem. Meach Lake, Que., Aug. 5, 1905, (Young). New to Quebec list.

5578. *Aristotelia rubidella* Clem. Meach Lake, Que., July 15, 1905, (Young). New to Quebec list.

Recurvaria piceaella K. Meach Lake, Que., June 19, 21, 1905, (Young). New to Quebec list.

5659. *Trichotaphe alacella* Clem. Trenton, Ont., July 9, 1911, (Evans).

5661. *Trichotaphe nonstrigella* Chamb. Meach Lake, Que., June 8, 1903; June 9, 1905, (Young). New to Quebec list.

5664. *Trichotaphe setosella* Clem. East Bolton, Que., July 18, 1911, (Winn). New to Quebec list.

5704. *Anacampsis niveopulvella* Chamb. Meach Lake, Que., July 15, 1904; July 28, 1905; Aug. 7, 1905, (Young). New to Quebec list.

5724. *Gelechia lugubrella* Fab. Trenton, Ont., May 31, June 2, 1911, (Evans).

5764. *Gelechia mediofuscella* Clem. Meach Lake, Que., May 26, 1905, (Young). New to Quebec list.

5765. *Gelechia walsinghami* Dietz. St. John's, Que., June 18, 1911, (W. Chagnon). New to Quebec list.

5918. *Euclemensia bassettella* Clem. Meach Lake, Que., July 23, 1902, (Young). New to Quebec list.

5920. *Epicallima argenticinctella* Clem. Meach Lake, Que., July 8, 1905, (Young). New to Quebec list.

6058. *Batrachetra praeangusta* Haw. Meach Lake, Que., July 27, 1905; Aug. 8, 1905, (Young). New to Quebec list.

6362. *Gracilaria stigmatella* Fab. Meach Lake, Que., Sept. 9, 1904, (Young). New to Quebec list.

6378. *Gracilaria burgessiella* Zell. Meach Lake, Que., Aug. 12, 1904; July 28, 1905; Aug. 2, 1905, (Young). New to Quebec list.

6418. *Lyonetia speculella* Clem. Meach Lake, Que., Aug. 22, 1905, (Young). New to Quebec list.

Argyresthia thuiella Pack. Hull, Que., (Gibson). New to Quebec list.

Monopis insignisella Walk. Dawson, Y.T. (Record received from Mr. Winn).

6503. *Tinea fuscipunctella* Haw. St. John's, Que., June 18, 1911, (W. Chagnon). New to Quebec list. Mr. Evans has taken this species at Trenton, Ont., in the middle of June.

6534. *Amadrya effrenatella* Clem. Meach Lake, Que., July 9, 1905, (Young). New to Quebec list.

6558. *Adela ridingsella* Clem. Meach Lake, Que., May 3, 1903; June 22, 1904; June 29, 1905, (Young). New to Quebec list.

6622. *Epimartyria auricrinella* Walsm. Meach Lake, Que., June 19, 1905, (Young). New to Quebec list.

Coleoptera.

(Arranged according to Henshaw's list of the Coleoptera of America, North of Mexico).

18c. *Cicindela montana* Lec. Yorktown, Sask., July, (Harms).

25f. *Cicindela limbalis* Kl. Yorktown, Sask., July, (Harms).

34. *Cicindela pusilla* Say. Yorktown, Sask., July, (Harms).

118. *Carabus chamissonis* Fisch. Rampart House, Y. T., (Nelles).

167. *Loricera caerulescens* Linn. Port Medway, N.S., Aug., (P. G. Bolster).

172. *Opisthius richardsoni* Kirby. Lethbridge, Alta., Aug. 22, (Miss D. Church).

175. *Notiophilus nitens* Lec. 18 miles south of Rampart House, Y. T., (Nelles).

195. *Nebria sahlbergi* Fisch. 18 miles south of Rampart House, Y. T., (Nelles).

449. *Tachys nanus* Gyll. 18 miles south of Rampart House, Y. T., (Nelles).

583. *Pterostichus luczotii* Dej. Banff, Alta., June 12, 1909, (Wallis).

595. *Pterostichus hudsonicus* Lec. 18 miles south of Rampart House, Y. T., (Nelles).

627. *Amara cylindrica* Lec. Winnipeg, Man., May 27, 1909, (Wallis).

667. *Amara protensa* Putz. Winnipeg, Man., May 7, 1909, (Wallis).

678. *Amara remotestriata* Dej. Peachland, B.C., July 24, 1909, (Wallis).

682. *Amara subaenea* Lec. Peachland, B.C., Aug. 5, 1909, (Wallis).

683. *Amara musculus* Say. Peachland, B.C., Aug. 2, 1909, (Wallis).

743. *Calathus ingratus* Dej. Aweme, Man., May 5, 1905, (Criddle); 10 miles south of Rampart House, Y. T., May 10, (Nelles).

794. *Platynus affinis* Kirby. Husavick, Man., July 11, 1910, (Wallis).

801. *Platynus hardyi* Lec. Weymouth, N.S., Aug., 1900, (P. G. Bolster).

823. *Platynus bembidioides* Kirby. Regina, Sask., May 24, (Willing).

990. *Zacotus matthewsii* Lec. Mt. Lahman, B.C., (S. Hadwin); Victoria, B.C., (E. H. Blackmore).

1029. *Chlaenius niger* Rand. Aweme, Man., (Criddle).
1043. *Oodes fluvialis* Lec. Ottawa, 1 sp., Oct. 18, (Beaulieu).
1081. *Harpalus amputatus* Say. 33 miles south of Rampart House, Y. T., (Nelles).
* *Haliplus vancouverensis* Matheson. "Vancouver Island, B.C.," Jour. N. Y. Ent. Soc., xx, 168.
* *Haliplus connexsus* Matheson. "Canada, (Nova Scotia)," Jour. N. Y. Ent. Soc. xx, 164.
1293. *Coelambus sellatus* Lec. Vernon, B.C., (Venables).
1423. *Agabus semipunctatus* Kirby. Vernon, B.C., (Venables).
1450. *Agabus clavatus* Lec. Vernon, B.C., hibernating in rotten logs in swamps, Nov. 7, (Venables).
1467. *Rhantus tostus* Lec. Vernon, B.C., April 12, (Venables).
1645. *Hydrobius tessellatus* Ziegl. Port Medway, N.S., July, (P. G. Bolster).
1646. *Hydrobius scabrosus* Horn. Millarville, Alta., (Dod).
1707. *Silpha trituberculata* Kirby. Aweme, Man., May 26, 1909,(E. Criddle); Husavick, Man., June 23, (Wallis).
2055. *Aleochara bimaculata* Grav. Aweme, Man., Aug. 22, 1910, (Criddle).
2096. *Heterothops fumigatus* Lec. Winnipeg, Man., May 8, 1909, (Wallis).
2103. *Quedius capucinus* Grav. Winnipeg, Man., May 21, 1909, (Wallis).
2179. *Philonthus longicornis* Steph. Port Medway, N.S., July, 1910, (P. G. Bolster).
2185. *Philonthus fusiformis* Melsh. Husavick, Man., Aug. 27, 1910, (Wallis).
2204. *Philonthus sordidus* Grav. Port Medway, N.S., July, 1910, (P. G. Bolster).
2303. *Stenus bipunctatus* Er. Vernon, B. C., (Venables).
2512. *Lathrobium punctulatum* Lec. Aweme, Man, (Criddle).
2647. *Conosoma knoxii* Lec. Aweme, Man., Oct. 11, 1910, (Criddle).
2681. *Olisthaerus megacephalus* Zett. 24 miles south of Rampart House, Y. T., (Nelles).
2682. *Olisthaerus substriatus* Gyll. Ottawa, Nov. 6, (Beaulieu).
9679. *Bledius strennus* Casey. Aweme, Man., May 26, 1909, (T. Criddle); June 29, 1911, (N. Criddle).
9690. *Bledius assimilis* Casey. Aweme, Man., (Criddle).
2712. *Bledius armatus* Er. Aweme, Man., July 30, 1907, (Criddle).
2715. *Bledius politus* Er. Aweme, Man., (Criddle).
2722. *Bledius rubiginosus* Er. Aweme, Man., May 28, (S. Criddle).
2749. *Oxytelus sculptus* Grav. Aweme, Man., (Criddle).
2753. *Oxytelus fuscipennis* Mann. Aweme, Man., Oct. 2, 1909, (Criddle).
2757. *Oxytelus nitidulus* Grav. Treesbank, Man., July 25, 1910, (Wallis).
3017. *Sacium lunatum* Lec. Ottawa, Sept., (Beaulieu).
3060. *Coccinella monticola* Muls. 18 miles south of Rampart House, Y.T., (Nelles).
3072. *Harmonia 12-maculata* Gebl. Aweme, Man., June 24, 1911, (E. Criddle).
3090. *Pentilia misella* Lec. Ottawa, Aug., (Beaulieu).
Hyperaspis nevadica Casey. Aweme, Man., (Criddle).
Hyperaspis inflexa Casey. Aweme, Man., (Criddle).
3112. *Hyperaspis proba* Say. Aweme, Man., July 4, 1911, (Criddle).
3147. *Scymnus brullei* Muls. Aweme, Man., Aug. 23, 1911, (Criddle).
3152. *Scymnus puncticollis* Lec. Aweme, Man., (Criddle).

3157. *Scymnus lacustris* Lec. Aweme, Man., May 18, 1905, (Criddle).
3314. *Pediacus fuscus* Er. Rampart House, Y.T., (Nelles).
* *Lasconotus schwarzi* Kraus. Victoria, B. C., (Hubbard & Schwarz, Proc. Ent. Soc. Wash., XIV, 37.
* *Simplocaria columbica* Csy. "British Columbia (Cariboo District)"
* *Morychus insulsus* Csy. Vernon, B. C., (Venables).
* *Cytilus longulus* Csy. "Washington State and British Columbia to Colorado."
* *Byrrhus brunnescens* Csy. "Lake Superior, (White Fish Point)."
* *Byrrhus manitobæ* Csy. Aweme, Man., (Criddle).
* *Byrrhus angustulus* Csy. Aweme, Man., (Criddle).
* *Byrrhus criddlei* Csy. Aweme, Man., (Criddle).
* *Byrrhus laramiensis* Csy. Aweme, Man., (Criddle).
* *Byrrhus egenus* Csy. Donald, B. C., (A. G. Smith).
* *Byrrhus consuetus* Csy. Aldermere, B. C., (Keen).
* *Porcinolus hystrix* Csy. Aweme, Man., (Criddle).
* *Lioligus striolatus* Csy. Metlakatla, B. C., (Keen).
* *Lioligus keeni* Csy. Metlakatla, B. C., (Keen).
* *Lioligus æquabilis* Csy. Victoria, B.C.,
* *Lioon speculare* Csy. Metlakatla, B.C., (Keen).

The above new species of Byrrhidæ are described by Thos. L. Casey in his Memoirs on the Coleoptera, III, issued March 20, 1912.

3797. *Corticaria pubescens* Gyll. Saskatoon, Sask., Oct. 9, (Willing).
3849. *Peltis ferruginea* Linn. 18 miles south of Rampart House, Y. T., (Nelles).
3929. *Elmis elegans* Lec. Port Medway, N.S., July, (P. G. Bolster).
3954. *Ancyronyx variegatus* Germ. Port Medway, N.S., July, (P. G. Bolster).
3970. *Heterocerus undatus* Melsh. Vernon, B.C., July, 1909, (Venables).
4003. *Helodes pulchella* Guer. Port Medway, N.S., July, 1910, (P. G. Bolster).
4478. *Corymbites triundulatus* Rand. Aweme, Man., (Criddle).
Poecilonota cupripes Casey. Husavick, Man., July 7, 1910 (Wallis).
4621. *Melanophila drummondi* Kirby. Rampart House, Y.T., (Nelles).
4623. *Melanophila gentilis* Lec. Peachland, B.C., July 19, (Wallis).
4646. *Chrysobothris carinipennis* Lec. Peachland, B.C., Aug. 2, (Wallis).
Chrysobothris verdigripennis Frost. Port Maitland, N. S., Aug. 2, 1910, (W. Rieff).
4716. *Chrysophana placida* Lec. Peachland, B.C., July 19, (Wallis). Mr. Harrington has one specimen taken on Vancouver Island, B.C.
4718. *Eupristocerus cognitans* Web. Greenfield, N.S., July 12, 17, 1910, (P. G. Bolster).
4742. *Agrilus politus* Say. Greenfield, N.S., July 13, 16, 1910, (P. G. Bolster).
Agrilus lateralis Say. Greenfield, N.S., July 13, 16; Port Medway, July 7, 1910, (P. G. Bolster).
Agrilus pensus Horn. Greenfield, N.S., July 13, 16; Port Medway, Aug. 14, 1910, (P. G. Bolster).
4787. *Eros aurora* Hbst. Banff, Alta., June 10, 1909, (Sanson).
4791. *Eros trilineatus* Melsh. Port Medway, N.S., July, 1910, (P. G. Bolster).
4815. *Ellychnia corrusca* Linn. Rampart House, Y.T., (Nelles).

5185. *Thanasimus undulatus* Say. 18 miles south of Rampart House, Y.T., (Nelles).
5185a. *Thanasimus nubilis* Kl. Rampart House, Y.T., (Nelles).
5468. *Aegialia lacustris* Lec. Husavick, Man., June 12, 1909, (Wallis).
5514. *Aphodius erraticus* Linn. Port Medway, N.S., July, 1910, (P. G. Bolster).
5552. *Aphodius brevicollis* Lec. Saskatoon, Sask., Oct. 3, (Willing).
5603. *Geotrupes balyi* Jek. Port Medway, N.S., July, 1910, (P. G. Bolster).
5658. *Dichelonycha canadensis* Horn. Millarville, Alta., (Dod).
5771. *Lachnosterna marginalis* Lec. Port Maitland, N.S., (W. Rieff).
* *Asemum brevicorne* Casey. "Ontario," Memoirs on the Coleoptera, III, by Thos. L. Casey, issued March 20, 1912.
* *Asemum costulatum* Casey. Aldermere, B.C., (Keene); Memoirs on the Coleoptera, III, by Thos. L. Casey, issued March 20, 1912.
5975. *Criocephalus agrestis* Kirby. 18 miles south of Rampart House, Y.T., (Nelles).
5974. *Criocephalus productus* Lec. Banff, Alta., Sept. 28, 1911, (Sanson).
5976. *Criocephalus asperatus* Lec. Banff, Alta., Sept. 8, 1911, (Sanson).
5981. *Tetropium velutinus* Lec. Aweme, Man., April 15, 1904, (Criddle).
* *Tetropium columbianum* Casey. Inverness, B.C., (Keen); Memoirs on the Coleoptera, III, by Thos. L. Casey, issued March 20, 1912.
5986. *Gonocallus collaris* Kirby. Aweme, Man., June 11, 1906, (Criddle).
* *Callidium frigidum* Casey. "Canada," Memoirs on the Coleoptera, III, by Thos. L. Casey, issued March 20, 1912.
* *Hypermallus canadensis* Casey. "Canada (Ontario)"; Memoirs on the Coleoptera, III, by Thos L. Casey, issued March 20, 1912.
6008. *Callidium antennatum* Newm. 18 miles south of Rampart House, Y.T., (Nelles).
6079. *Tylonotus bimaculatus* Hald. Ottawa, Aug.-Sept., (Beaulieu).
6092. *Obrium rubrum* Newm. Aweme, Man., June 29, 1903, (Criddle).
6099. *Molorchus longicollis* Lec. Vernon, B.C., at thorn blossom, May, 1908, (Venables).
6129. *Purpuricenus humeralis* Fab. March, Ont., (Miss Sweeney).
6141. *Batyle saturalis* Say. Saskatoon, Sask., July 4, (Willing).
6168. *Cyllene antennatus* White. Victoria, B.C., July 11, (Miss Farmer).
6172. *Cyllene decorus* Oliv. Lethbridge, Alta., Aug. 26, (Wallis).
* *Xylotrechus columbianus* Casey. Aldermere, B.C., (Keen); Memoirs on the Coleoptera, III, by Thos. L. Casey, issued March 20, 1912.
6183. *Xylotrechus undulatus* Say. 18 miles south of Rampart House, Y.T., (Nelles).
6197. *Neoclytus conjunctus* Lec. Victoria, B.C., 1911, (Miss Farmer).
6199. *Neoclytus muricatulus* Kirby. Greenfield, N.S., July, 1910, (P. G. Bolster).
6226. *Necydalis lævicollis* Lec. Victoria, B.C., July, (E. H. Blackmore).
6233. *Centrodera decolorata* Harr. Port Medway, N.S., (W. P. Henderson).
6240. *Toxotus trivittatus* Say. Aweme, Man., July 11, 1911, (Criddle).
6266. *Acmæops supilosa* Lec. Banff, Alta., June 26, 1911, (Sanson).
6273. *Acmæops proteus* Kirby. 18 miles south of Rampart House, Y.T., (Nelles).

6274. *Acmæops pratensis* Laich. 18 miles south of Rampart House, Y.T., (Nelles).
6297. *Leptura emarginata* Fab. Near Parry Sound, Ont., June, (record sent by L. Caesar).
6304. *Leptura subhamata* Rand. Chelsea, Que., males and females *in coitu,* July 14, (Gibson); Hochelaga, Que., June, 1897, (Beaulieu).
6323. *Leptura instabilis* Hald. Banff, Alta, July 25, 1910, (Sanson).
6330. *Leptura nigrella* Say. Aweme, Man., June 15 to July 4, (E. & N. Criddle).
6340. *Leptura quadrillum* Lec. Shawnigan, B.C., July 8, (Wallis).
6446. *Acanthocinus obliquus* Lec. Peachland, B.C., July 19, (Wallis).
6477. *Saperda obliqua* Say. Port Medway, N.S., July, 1910, (P. G. Bolster).
6481. *Saperda cretata* Newm. Winnipeg, Man., June 30, 1911, (Wallis).
6495. *Oberea tripunctata* Swed., var. *bimaculata* Oliv., form *aculaticollis* Say. Winnipeg, Man., June 17, 1911, (Wallis).
6496b. *Oberea basalis* Lec. Aweme, Man., June 25, 1911, (E. Criddle).
6503b. *Oberea mandarina* Fab. Winnipeg, Man., June 10, 1911, (Wallis); Port Medway, N.S., July, (P. G. Bolster).
6715. *Triachus atomus* Suffr. Greenfield, N.S., July, 1910, (P. G. Bolster).
6725. *Fidia viticida* Walsh. Windsor, Ont., July 6, specimens of adults and injured foliage sent to Division the past summer. The only Ontario record I have. On May 28, 1908, Mr. J. M. Swaine found the beetle at Macdonald College, Que., and in the following year the insect was again found at the same place, in small numbers.
Rhabdopterus picipes Oliv. Treesbank, Man., July 29, 1910, (Wallis).
6782. *Prasocuris obliquata* Lec. Vernon, B.C., (Venables).
6827. *Plagiodera oviformis* Lec. Vernon, B.C., March, 1908, (Venables).
6842. *Gonioctena arctica* Mann. Rampart House, Y.T., (Nelles).
6905a. *Galeruca punctipennis* Mann. Vernon, B.C., June, 1910, (Venables).
6917. *Monoxia consputa* Lec. Vernon, B.C., (Venables).
6932. *Oedionychis vians* Ill. Port Medway, N.S., July, 1910, (P. G. Bolster).
6933. *Oedionychis lugens* Lec. Banff, Alta., May 5, 1910, (Sanson).
6945b. *Oedionychis limbalis* Melsh. Port Medway, N.S., Aug. 1912, (P. G. Bolster).
10416. *Disonycha crenicollis* Say. Banff, Alta., May 18, 1911, (Sanson).
6988. *Crepidodera subcrinita* Lec. Vernon, B.C., July, (Venables).
7027. *Phyllotreta albionica* Lec. Vernon, B.C., July, (Venables).
7032. *Mantura floridana* Cr. Port Medway, N.S., July, (Venables).
7068. *Microrhopala cyanea* Say. Aweme, Man., May 24, 1910, (Criddle).
7124. *Bruchus discoideus* Say. Treesbank, Man., July 21, 1910, (Wallis).
7661. *Carebara longula* Lec. Port Medway, N.S., July, 1910, (P. G. Bolster).
7696. *Stenotrachelus arctatus* Say. Banff, Alta., Sept. 29, 1911, (Sanson).
7717. *Salpingus virescens* Lec. Saskatoon, Sask., July 20, (Willing).
7724. *Calopus angustus* Lec. Banff, Alta., May 5, 1911, (Sanson).
7846. *Mordellistena unicolor* Lec. Banff, Alta., Aug. 13, 1909, (Sanson).
7975. *Anthicus coracinus* Lec. Port Medway, N.S., July, 1910, (P. G. Bolster).
8306. *Chætechus setiger* Horn. Port Medway, N.S., July, 1910, (P. G. Bolster).
8360. *Lepidophorus lineaticollis* Kirby. Yukon Crossing, Y.T., (Nelles).

8430. *Phytonomus comptus* Say. Lumsden, Sask., July 18. (Willing).
8436. *Lepyrus gemellus* Kirby. Banff, Alta., Aug. 5, 1911, (Sanson).
8473. *Pissodes costatus* Mann. Rampart House, Y.T., (Nelles).
8479. *Hylobius pales* Hbst. Saskatoon, Sask., June 22, (Willing).
8487. *Lixus rubellus* Rand. Vernon, B.C., Sept. (Venables).
8532. *Dorytomus brevicollis* Lec. Banff, Alta., Nov. 6, 1910, on snow, (Sanson); Saskatoon, Sask., Sept. 29, (Willing).
8630. *Anthonomus quadrigibbus* Say. Aweme, Man., May 24, 1912; June 5, 1903. (E. & N. Criddle).
* *Trypophloeus nitidus* Swaine. Weymouth, N.S., (Sanders); Can. Ent. xliv, 349.

Diptera.

(Arranged according to a catalogue of North American Diptera, by J. M. Aldrich, Smithsonian Misc. Coll. XLVI, No. 1,444. The numbers refer to the pages in the catalogue).

Considerable collecting in this order was done during 1912. The tipulids mentioned below were all determined by Dr. Deitz, and although some of the species are not what one might term rare, the definite records are valuable, as they add to the known distribution of the insects.

78. *Rhipidia maculata* Meig. Ottawa, Aug. 7, (Beaulieu); Aweme, Man., (Criddle); Winnipeg, Man., Sept., (Wallis).
78. *Dicranomyia brevivena* O. S. Winnipeg, Man., Sept., (Wallis).
79. *Dicranomyia distans* O. S. Rigaud, Que., June 25, 1906, (Beaulieu); Ameme, Man., (Criddle); Winnipeg, Man., June, (Wallis).
79. *Dicranomyia haeretica* O. S. Aweme, Man., (Criddle).
79. *Dicranomyia immodesta* O. S. Montreal, June 14, 1906; Rigaud, Que., June 25, 1906, (Beaulne); Ottawa, Aug. 29, (Beaulne); Aweme, Man., (Criddle); Winnipeg, Man., Sept. (Wallis).
79. *Dicranomyia liberta* O. S. Montreal, June 14, 1906, (Beaulieu); Ottawa, Aug. 29, Sept. 8, Oct. 12, (Beaulne); Aweme, Man., (Criddle).
79. *Dicranomyia moriodes* O. S. Aweme, Man., (Criddle).
79. *Dicranomyia pudica* O. S. Montreal, June 10, 1906, (Beaulieu).
80. *Dicranomyia venusta* Berg. Peachland, B.C., Aug., (Wallis).
80. *Limnobia cinctipes* Say. Aweme, Man., (Criddle); Husavick, Man., June, (Wallis).
80. *Limnobia immatura* O. S. Winnipeg, Man., June, (Wallis).
81. *Limnobia solitaria* O. S. Ottawa, Sept. 5, (Beaulne); Aweme, Man., (Criddle); Husavick, Man., Aug., (Wallis).
81. *Limnobia triocellata* O. S. Aweme, Man., (Criddle).
81. *Limnobia tristigma* O. S. Aweme, Man., (Criddle).
81. *Rhamphidia flavipes* Macq. Montreal, Aug. 5, 1906, (Beaulieu); Ottawa, Sept. 2, 13, (Beaulne); Husavick, Man., July, (Wallis).
* *Elliptera astigmatica* Alex. Roger's Pass, B.C., July 30, 1908, (J. C. Bradley); Psyche, xix, 164.
85. *Erioptera septemtrionalis* O. S. Montreal, June 10, 1906, (Beaulieu); Ottawa, Oct. 4, (Beaulne).

85. *Goniomyia blanda* O. S. Peachland, B.C., June, (Wallis).
89. *Epiphragma fascipennis* Say. Ottawa, July 2, (Beaulne).
89. *Limnophila adusta* O. S. Husavick, Man., July, (Wallis).
90. *Limnophila quadrata* O. S. Montreal, June 24, (Winn); Ottawa, Aug. 29, (Beaulne).
94. *Pedicia albivitta* Walk. Ottawa, Aug. 24, (Beaulne); Aweme, Man., (Criddle).
94. *Liogma nodicornis* O. S. Stoke Centre, Que., June 26, (Winn).
95. *Bittacomorpha clavipes* Fab. Montreal, Aug. 14, 1906, (Beaulieu); Aweme, Man., (Criddle).
Oropeza obscura John. Rigaud, Que., June 27, 1906, (Beaulieu); Peachland, B.C., Aug., (Wallis).
Oropeza albipes John. Montreal, June 27, 1906, (Miss Beaulieu).
97. *Xiphura fumipennis* O. S. Montreal, June 10, 1906, (Beaulieu).
97. *Pachyrhina altissima* O. S. Aweme, Man., (Criddle).
97. *Pachyrhina collaris* Say. Montreal, July 18, 1908, (Beaulieu).
97. *Pachyrhina erythrophrys* Will. Aweme, Man., (Criddle); "Br. Col.", Aug. 14, 1910 (record received from Beaulieu); Winnipeg, Man., June, (Wallis).
97. *Pachyrhina eucera* Loew. Montreal, July 18, 1906, (Beaulieu); Ottawa, Aug. 30, 1912, (Beaulne).
98. *Pachyrhina ferruginea* Fab. Ottawa, July 4, Sept. 10, Oct. 2, (Beaulne). Aweme, Man., (Criddle); Winnipeg, Man., June, (Wallis).
98. *Pachyrhina incurva* Loew. Ottawa, June 3, (Beaulne).
98. *Pachyrhina lineata* Scop. Montreal, June 17, 1906, (Beaulieu); Ottawa, Oct. 8, (Beaulne).
98. *Pachyrhina lugens* Loew. Ottawa, July 4; (Beaulne).
98. *Pachyrhina occipitalis* Loew. Aweme, Man., (Criddle); Winnipeg, Man., Sept., (Wallis).
98. *Pachyrhina sodalis* Loew. Montreal, July 21, 1906, (Beaulieu); Ottawa, Sept. 24, (Beaulne).
101. *Tipula abdominalis* Say. Ottawa, Sept., 10, (Beaulne).
101. *Tipula angustipennis* Loew. Ottawa, June 3, Oct. 8, (Beaulne); Aweme, Man., (Criddle); Winnipeg, Man., June, (Wallis).
101. *Tipula bicornis* Loew MS. Newaygo, Que., June 9, (Winn); Montreal, June 7, (Beaulieu).
101. *Tipula calva* Doane. Rigaud, Que., June 25, 1910 (Beaulieu); Ottawa, July 8, (Beaulne).
101. *Tipula cincticornis* Doane. Montreal, Aug. 21, 1906, (Beaulieu).
101. *Tipula costalis* Say. Ottawa, Sept. 3, (Beaulne).
101. *Tipula cunctans* Say. Aweme, Man., (Criddle).
102. *Tipula eluta* Loew. Ottawa, Sept. 29, (Beaulne).
102. *Tipula flavicans* Fab. Ottawa. Sept. 5, (Beaulne); Aweme, Man., (Criddle); Peachland, B.C., Aug., (Wallis).
102. *Tipula hebes* Loew. Ottawa, Aug. 30, Sept. 10, Oct. 4, (Beaulne); Aweme, Man., (Criddle).
102. *Tipula illustris* Doane. Rigaud, Que., June 25, 1906, (Beaulieu).
102. *Tipula impudica* Doane. Peachland, B.C., Aug., (Wallis).
102. *Tipula inermis* Doane. Montreal, June 17, 1906, (Beaulieu).

103. *Tipula pallida* Loew. Newaygo, Que., June 9, (Winn).
104. *Tipula serta* Loew. Ottawa, July 8, (Beaulne); Aweme, Man., (Criddle); Peachland, B.C., June, (Wallis).
104. *Tipula sulphurea* Doane. Montreal, July 18, 1908, (Beaulieu); Aweme, Man., (Criddle).
104. *Tipula triviltata* Say. Montreal, June 14, 1910, (Beaulieu); Husavick, Man., June, (Wallis).
143. *Epicypta punctum* Stan. Ottawa, reared from a myxomycete (*Reticularia lycoperdon* Fall), emerged in late autumn, (J. W. Eastham).
* *Allodia bella* Johannsen. Downie Creek, Selkirk Mt., B.C., Aug., (J. C. Bradley); Bull, 196, Maine Agri. Exp. Station, p. 319.
* *Exechia nugax* Johannsen. Rouville Co., Que.; Bull. 200, Maine Agric. Exp. Station, p. 68.
* *Exechia palmata* Johannsen. Selkirk Mts., B.C., (J. C. Bradley); Bull. 200, Maine Agric. Exp. Station, p. 71.
* *Mycetophila edentula* Johannsen. Selkirk Mts., Rogers' Pass, B.C., July, (J. C. Bradley); Bull. 200, Maine Agric. Exp. Station, p. 105.
* *Mycetophila pectita* Johannsen. Selkirk Mts., B.C., (J. C. Bradley); Bull. 200, Maine Agric. Exp. Station, p. 101.
* *Dynatosoma placida* Johannsen. Kearney, Ont., July, (M. C. Van Duzee); Bull. 200, Maine Agric. Exp. Station, p. 77.
* *Sciara abdita* Johannsen. Kearney, Ont., (M. C. Van Duzee); Bull. 200, Maine Agric. Exp. Station, p. 125.
* *Sciara habilis* Johannsen. Kearney, Ont.; Bull. 200, Maine Agric. Exp. Station, p. 126.
* *Nemotelus bonnarius* John. Fairwell Creek, South Saskatchewan, Aug., 1907, (Mrs. V. A. Armstrong); Psyche, Vol. XIX, p. 4.
195. *Chrysops mærens* Walk. Husavick, Man., July 5, 1910, (Wallis).
199. *Haematopota americana* O. S. Husavick, Man., July 7, 1910, (Wallis).
200. *Tabanus affinis* Kirby. 18 miles south of Rampart House, Y.T., (Nelles).
203. *Tabanus epistates* O.S. Bird's Hill, Man., June 5, 1909, (Wallis).
204. *Tabanus illotus* O. S. Husavick, Man., July 4, 1910 (Wallis).
204. *Tabanus lineola* Fab. Winnipeg, Man., June 23, 1910, (Wallis).
207. *Tabanus septentrionalis* Loew. Husavick, Man., Aug. 18, 1910, (Wallis).
231. *Anthrax gracilis* Macq. Lumsden, Sask., July 18, 1910, (Willing).
232. *Anthrax molitor* Loew. Phippen, Sask., July 16, 1909, (Willing).
237. *Anastoechus nitidulus* Fab. Moose Jaw, Sask., Aug. 12, 1909, (Willing).
248. *Thereva duplicis* Coq. Regina, Sask., July 25, 1907, (Willing).
* *Thereva ustulata* Kröber. "Laval Co., Que."; Stettiner Entomologische Zeitung, 1912, p. 265.
248. *Thereva nigra* Say. Battleford, Sask., July 1, 1907, (Willing).
256. *Stenopogon morosus* Loew. Saskatoon, Sask., Aug. 3, 1907, (Willing).
293. *Sympycnus lineatus* Loew. Ottawa, July 2, (Beaulieu).
294. *Neurigona lateralis* Say. Ottawa, July 2, (Beaulieu).
299. *Dolichopos albicoxa* Aldrich. Ottawa, July 2, (Beaulieu).
300. *Dolichopos brevimanus* Loew. Ottawa, July 2, (Beaulieu).
300. *Dolichopos calcaratus* Aldrich. Ottawa, July 2, (Beaulieu).
301. *Dolichopos flagellitenens* Wheeler. Ottawa, July 2, (Beaulieu).
302. *Dolichopos lobatus* Loew. Ottawa, July 2, (Beaulieu).

303. *Dolichopos palaestricus* Loew. Ottawa, July 2, (Beaulieu).
305. *Gymnopternus barbatulus* Loew. Ottawa, July 2, (Beaulieu).
305. *Gymnopternus difficilis* Loew. Ottawa, July 2, (Beaulieu).
309. *Pelastoneurus vagans* Loew. Ottawa, July 2, (Beaulieu).
* *Pinunculus caudelli* Malloch. Kaslo, B.C., July 16, 1903, (A. N. Caudell); Proc. U. S. N. M., Vol. 43, p. 299.
* *Pipunculus exilis* Malloch. Medicine Hat, Alta., (Malloch); Proc. U. S. N. M., Vol. 43, p. 295.
* *Pipunculus inconspicuus* Malloch. Medicine Hat, Alta., Oct., 1911, (Malloch), Proc. U. S. N. M., Vol. 43, p. 296.
* *Pipunculus occidentalis* Malloch. Medicine Hat, Alta., Oct., 1911, (Malloch); Proc. U. S. N. M., Vol. 43, p. 292.
* *Pipunculus stigmatica* Malloch. Kaslo, B.C., July 16, 1903, (A. N. Caudell); Proc. U. S. N. M., Vol. 43, p. 294.
* *Pipunculus trochanteratus* Malloch. Kaslo, B. C., (R. P. Currie; Proc. U. S. N. M., Vol. 43, p. 298.
* *Paraspiniphora trispinosa* Malloch. Kaslo, B.C., June 22, 1903, (R. P. Currie); Proc. U. S. N. M., Vol. 43, p. 427.
* *Aphixæta conglomerata* Malloch. Kaslo, B.C., (A. N. Caudell); Proc. U. S. N. M., Vol. 43, p. 446.
* *Aphiochæta ursina* Malloch. London Hill Mine, Bear Lake, B.C., July 29, 1903, altitude 7,000 feet, (R. P. Currie); Proc. U. S. N. M., Vol. 43, p. 476.
* *Aphiochæta monticola* Malloch. Kokanee Mountains, B.C., 8,000 feet, Aug. 11, 1903, (R. P. Currie); Proc. U. S. N. M., Vol. 43, p. 479.
* *Apiochæta dubitata* Malloch. Kokanee Mountains, B.C., 8,000 feet, Aug. 11, 1903, (R. P. Currie); Proc. U. S. N. M., Vol. 43, p. 481.
* *Aphiochæta atomella* Malloch. Oxbow, Sask., (F. Knab); Proc. U.S.N.M., Vol. 43, p. 481.
* *Aphiochæta borealis* Malloch. Kaslo, B.C., July 8, 1903, (R. P. Currie); Proc. U. S. N. M., Vol. 43, p. 489.
* *Aphiochæta perplexa* Malloch. London Hill Mine, Bear Lake, Kaslo, B.C., 7,000 feet, July 21, 1903, (R. P. Currie).
* *Aphiochæta dyari* Malloch. Kaslo, B.C., (H. G. Dyar); Proc. U. S. N. M., Vol. 43, p. 493.
* *Aphiochæta fuscopedunculata* Malloch. Kaslo, B.C., June 25, 1903, (R. P. Currie); Proc. U. S. N. M., Vol. 43, p. 499.
* *Plastophora curriei* Malloch. Kaslo, B.C., (R. P. Currie); Proc. U. S. N. M., Vol. 43, p. 501.
349. *Chrysogaster pulchella* Will. Ottawa, July 2, (Beaulieu).
* *Helophilus willingii* Smith. Regina, Sask., June 19, 1905, male; July 8, 1906, female; (Willing); Proc. Ent. Soc. Wash., Vol. XIV, p. 119.
350. *Pipiza nigripilosa* Will. Ottawa, Aug. 18, (Beaulne).
359. *Platychirus chætopodus* Will. Ottawa, Aug. 16, Sept. 8, (Beaulne).
368. *Syrphus xanthostoma* Will. Ottawa, Aug. 20, (Beaulne).
423. *Alophora æneoventris* Will. Ottawa, Sept. 17, 1911, (Tothill).
428. *Eulasiona comstocki* Town. Chelsea, Que., May 30, 1908, (Fletcher).
445. *Plagia americana* Van der Wulp. Ottawa, June 10, 1901, (Gibson).
Varichaeta aldrichi Town. Ottawa, (Gibson).
456. *Exorista cheloniæ* Rond. Chelsea, Que., (Tothill).

457. *Exorista endryæ* Town. Ottawa, Aug. 27, 1906, (Fletcher).
457. *Exorista futilis* O. S. Ottawa, May 21, (Fletcher).
458. *Exorista nigripalpis* Town. Ottawa, Sept., 11, 1908, (Fletcher); Chicoutimi, Que., Maniwaki, Que., specimens emerged at Ottawa in June, 1911, in Div. of Ent.
458. *Exorista pyste* Walk. Chicoutimi, Que., specimens emerged at Ottawa, July 3, 1911, in Div. of Ent.
464. *Sturmia albifrons* Walk. Ottawa, (Fletcher).
464. *Sturmia iniquinata* Van der Wulp. Ottawa, May 22, 1900, (Gibson); June 11, 1900, (Young).
466 *Masicera eufitchiæ* Town. Ottawa, May 18, 1900, (Gibson).
470. *Tachinomyia robusta* Town. Ottawa, June 22, 1908, (J. A. Letourneau); May 22, 1900, (Gibson).
472. *Blepharipeza adusta* Loew. Ottawa, June 16, 1908, (Gibson).
472. *Blepharipeza leucophrys* Wied. Meach Lake, Que., July 21, 1907; (Fletcher).
* *Winthemia fumiferanæ* Tothill. Maniwaki, Que., Duncan's, B.C., reared in Div. of Ent., Ottawa; Can. Ent. Vol. XLIV, p. 3.
473. *Winthemia quadripustulata* Fab. Ottawa, June 26, 1904, (Metcalfe); May 5, 1901, (Fletcher).
475. *Phorichaeta sequax* Will. Ottawa, June 10, 1903, (Gibson).
576. *Borborus geniculatus* Macq. Montreal, Oct. 1, 1905, (Beaulieu).
640. *Stegana coleoptrata* Scop. Montreal, June 14, 1906, (Beaulieu).
655. *Ornithoica confluens* Say. Ottawa, from English Sparrow, Sept. 27, 1909, (Hewitt).

Hymenoptera.

Little collecting has been done in this order during the past season, and only small collections obtained previously have been worked up. Consequently few records are included this year. Mr. F. W. L. Sladen, Assistant Entomologist for Apiculture, Div. of Entomology, Exp. Farm, is making a special study of the aculeate hymenoptera and would be glad to receive specimens from any locality.

Myrmica brevinodes Em., var *whymperi* Forel. Banff, Alta., June 18, 1908, (Sanson). Recorded from British Columbia.

Myrmica scabrinodis Nyl., var. *glacialis* Forel. Banff, Alta, May 21, 1908, (Sanson). Recorded from Brit. Col.

Lasius niger L., var. *americanus* Em. Banff, Alta., May 28, 1908, (Sanson).

Lasius umbratus mixtus Nyl. var. *aphidicola* Walsh. Banff, Alta., May 15, 1911, (Sanson).

Formica rufa L. subsp. *obscuripes* Forel. Banff, Alta., June 16, 1908, (Sanson).

Formica fusca L. var. *argentata* Wheeler. Banff, Alta., May 2, 1908, (Sanson).

Formica fusca L. var. *neorufibarbis* Em. Banff, Alta., May 21, 1908, (Sanson).

Camponotus herculeanus L. var. *whymperi* Forel. Banff, Alta., June 8, 1908, (Sanson).

* *Cephaleia criddlei* MacGillivray. Aweme, Man.; Can. Ent. XLIV, 297.

* *Pamphilius nigritibialis* Rohwer. Oxbow, Sask., June 15, 19, 1907, (F. Knab); Proc. U. S. N. M., Vol. 43, 206.

* *Macrophya zabriskiei* Rohwer. "One male from Canada, C. F. Baker collection"; Proc. U. S. N. M., Vol. 43, 218.

* *Tenthredo anomocerus* Rohwer. Banff, Alta., (Sanson); Proc. U. S. N. M., Vol. 43, 223.

* *Monophadnus truncatus* Rohwer. Oxbow, Sask, June 1, 1907, (F. Knab); Proc. U. S. N. M., Vol. 43, 232.

* *Pracharactus nigrisomus* Rohwer. Oxbow, Sask., June 21, 1907, (F. Knab); Proc. U. S. N. M., Vol. 43, 232.

* *Euura serissimae* Rohwer. Toronto, Ont., (A. Cosens); Proc. U. S. N. M., Vol. 43, 240.

* *Euura nigrella* Rohwer. Fort Erie, Ont., April 7, 1910, (M.C. VanDuzee); Proc. U. S. N. M., Vol. 43, 241.

* *Pontania crassicornis* Rohwer. Toronto, Ont., (A. Cosens); Proc. U. S. N. M., Vol. 43, 242.

* *Pontania lucidæ* Rohwer. Toronto, Ont., (A. Cosens); Proc. U. S. N. M., Vol. 43, 242.

* *Amauronematus knabi* Rohwer. Oxbow, Sask., June 15, 19, 1907, (F. Knab). Proc. U. S. N. M., Vol. 43, 245.

Sirex abdominalis Harris. Banff, Alta., summit of Sulphur Mt., Sept. 9, 1907, (Sanson).

Sirex bizomatus Steph. Banff, Alta., Aug. 23, 1911, (Sanson).

Sirex flavicornis Fabr. Banff, Alta., Aug. 29, 1909, (Sanson).

* *Apanteles fumiferanæ* Viereck. Reared at Ottawa from Spruce Budworm material received from Montcalm and Chicoutimi, Que., issued June 18, 20, 1911; Proc. U. S. N. M., Vol. 42, 139.

* *Meteoris trachynotus* Viereck. Maniwaki, Que., issued June 20, July 3, 1911; Proc. U. S. N. M., Vol. 42, 142.

* *Conoblasta fumiferanæ* Viereck. Maniwaki, Que., Duncan's and Esquimault, B.C.; Proc. U. S. N. M., Vol. 42, 148.

* *Epiurus innominatus* Viereck. Esquimault, B.C.; Proc. U. S. N. M., Vol., 42, 149.

* *Phygadeuon plesius* Viereck. Maniwaki, Que.; Proc. U. S. N. M., Vol. 42, 148.

* *Mesochorus diversicolor* Viereck. Duncan's, B.C., issued July 18, 25, 1911; Proc. U. S. N. M., Vol. 42, 149.

Amblyteles fraternus Cress. St. Therese, Que., (Mignault).

Trogus canadensis Prov. St. Therese, Que., (Mignault).

* *Polynema regina* Girault. Vancouver, B.C.; Proc. Ent. Soc., Wash., Vol. xiv., 24.

* *Rhopoideus fuscus* Girault. Maniwaki, Que., Montcalm, Que., St. Gabriel de Brandon, Que., reared at Ottawa; Can. Ent., xliv., 7.

* *Dasymutilla coloradella kamloopsensis* Rohwer. Kamloops, B.C., (Wickham); Proc. U. S. N. M., Vol. 41, 459.

Ammophila gryphus Smith. St. Therese, Que., (Mignault).

* *Chelynia ricardonis* Cockerell. Vernon, B.C., June 19, 1902, (Miss Ricardo); Can. Ent., xliv., 293.

* *Megachile vernonensis.* Cockerell. Vernon, B.C., July 7, 1902, (Miss Richardo); Can. Ent., XLIV, 354.

* *Osmia novaescotiae* Cockerell. "Nova Scotia (Ent. Club)"; Can. Ent. XLIV, 356.

* *Osmia subarctica* Cockerell. "Hudson's Bay"; Can. Ent. XLIV, 357.

* *Osmia tersula* Cockerell. "Hudson's Bay"; Can. Ent. XLIV, 358.

* *Phileremulus mallochi* Crawford. Medicine Hat, Alta.; Can. Ent. XLIV, 360.

* *Perdita canadensis* Crawford. Medicine Hat, Alta., Can. Ent., XLIV, 360.

Hemiptera.

During the past year several small collections of hemiptera have been determined by our good friend Mr. E. P. Van Duzee. In July last Mr. Van Duzee visited Canada, and while at Ottawa, Montreal, and other points collected some interesting species (See *The Ottawa Naturalist*, Aug.—Sept. issue, 1912). While in Canada he also visited Quebec City, where he made a study of the Provancher collection. The results of this study are given in *The Canadian Entomologist*, Nov., 1912.

Ceresa brevis Walk. Banff, Alta., Sept. 8, 1909, (Sanson).

Thelia bimaculata Fabr. St. Ives, Ont., (H. F. Hudson).

Carynota stupida Walk. "Rat Portage," Ont., (now called Kenora); no collector's name on label.

Glossonatus godingi Van D. Winnipeg, Man., June 24, 1911, (Wallis).

Telamona pyramidata Uhler. Regina, Sask., Aug. 10.

Platycotis nigromaculata Prov. (var. of *sagittata* Germ.). Victoria, B.C.

Elidiptera septentrionalis Prov. Aweme, Man., (Criddle).

* *Lamenia maculata* Van D. Trenton, Ont., Aug. 17, 1911, (Evans); Bull. Buffalo Soc. Nat. Sciences, Vol. x., 503, June, 1912.

Stenocranus felti Van D. Winnipeg, Man., May 26, 1909, (Wallis).

Aphrophora angulata Ball. Victoria, B.C., (Hanham).

Aphrophora permutata Uhler. Duncan's, B.C., July 4, 1911, (Hanham),

Gypona albosignata Uhler. Winnipeg, Man., June 30, 1911, (Wallis).

Pagaronia 13-*punctata* Ball. Victoria, B.C., (Hanham).

Oncopsis sobrinus Walk. Kaslo, B.C., (Cockle).

Dicraneura carneola Stal. Ottawa, (Metcalfe).

Typhlocyba comes var. *infuscata* Gill. Ottawa, (Metcalfe).

Typhlocyba lethierryi Edw. Ottawa, (Metcalfe).

* *Aphalara fascipennis* Patch. Hull, (Beaver Meadow), Que., June 7, 27, 1903, (Metcalfe); Maine Agric. Exp. Station, Bull. 202, 217, issued Sept. 20, 1912.

* *Psylla breviata* Patch. Ottawa, June 14, 1903, (Metcalfe); Maine Agric. Exp. Station Bull. 202, 220, issued Sept. 20, 1912.

* *Trioza aylmeriæ* Patch. Aylmer, Que., May 20, 1906, (Metcalfe); Maine Agric. Exp. Station Bull. 202, 225, issued Sept. 20, 1912.

* *Trioza forcipula* Patch. Hull, Que., May 17, July 26, 1903; Ottawa, May 29, June 5, 1904, (Metcalfe); Maine Agric. Exp. Station, Bull. 202, 227, issued Sept. 20, 1912.

* *Trioza stylifera* Patch. Brockville, Ont., Oct. 25, 29; Nov. 1, 15, 1903, (Metcalfe); Maine Agric. Exp. Station, Bull. 202, 229; issued Sept. 20, 1912.

* *Neotriozella ottawanensis* Patch. Ottawa, June 1, 1904, (Metcalfe); Maine Agric. Exp. Station, Bull. 202, 231; issued Sept. 20, 1912.

Pentatoma ligata Say. Banff, Alta., (Sanson).

Pentatoma uhleri Stal. Kaslo, B.C., Aug. 28, 1905, (Cockle).

Aradus debilis Uhler. British Columbia, March 10, (G. W. Taylor).

Aneuris septentrionalis Walk. Nepigon, Ont., (J. Fletcher).

Nysius minutus Uhler. Saskatoon, Sask., July 22, 1907, (J. Fletcher).

Trapezonotus agrestis Fallen. Winnipeg, Man., June 6, 1911, (Wallis).

Tollius setosus Van D. Ruby, Sask., (J. Fletcher).

Stictopleurus crassicornis Linn. Nepigon, Ont., June 25, 1895, (J. Fletcher).

Liorhyssus viridicatus Uhler. Saskatoon, Sask., Aug. 23, 1907, (J. Fletcher).

Corythuca incurva Uhler. Aweme, Man., June 5, 1904, (Criddle).

Tingis clavata Stal. Winnipeg, Man. June 30, 1911, (Wallis).

Rasahus thoracicus Stal. Victoria, B.C., May 1, 1905, (Hanham).

Ranatra americana Montd. Selkirk, Man., Sept. 23, 1911, (Wallis).

Macrotylus tristis Uhler. Ottawa, July 25, 1908, (Gibson).

Diaphnidia capitata, Van D. Ottawa, on hazel nut, July 26, 1903; Aug. 2, 1904, (Metcalfe).

Trigonotylus tarsalis Reut. Winnipeg, Man., June 24, 1911, (Wallis).

Adelphacoris superbus Uhler. Ruby, Sask., July 19, 1907, (J. Fletcher).

* *Tropidosteptes canadensis* Van D. Ottawa, on white ash, Aug. 1, 1904, (Metcalfe); Bull. Buffalo Soc. Nat. Sciences, Vol. x., 486, June, 1912.

* *Criocoris canadensis* Van D. North Hatley, Como and Lachine, Que., July and August, (G. A. Moore); Bull. Buffalo Soc. Nat. Sciences, Vol. x., 511, June, 1912. Mr. Metcalfe has also taken the species at Ottawa, June 27, 1903, and at Hull, Que., June 24, 1911.

Irbisia brachycerus Uhler. Massett, Queen Charlotte Islands, (Keen).

Irbisia sericans Stal. Massett, Q. C. I., June 15, 1892, (Keen).

Camptobrochis validus Reut. Victoria, B.C., (G. W. Taylor).

Orectoderes obliquus Uhler. Winnipeg, Man., June 24, 1911, (Wallis); Calgary, Alta., (J. Fletcher).

Horcias dislocatus var. *nigrita* Reut. Winnipeg, Man., June 30, 1911.

Salda explanata Uhler. Little Current River, Hudson Bay Slope, July 11, 1903, (W. J. Wilson).

Salda coriacea Uhler. Nepigon, Ont., July 14, 1892, (J. Fletcher).

Neuropteroid Insects (Except Odonata).

(Arranged according to a catalogue of the Neuropteroid Insects (except Odonata) of the United States, by Nathan Banks; American Entomological Society, 1907. The numbers refer to the pages of the catalogue.)

Archiptera.

10. *Acroneura abnormis* Newm. Banff, Alta., Sanson.
11. *Isogenus frontalis* Newm. Rosebank, Ont., (P. Halm).

12. *Perla lycorias* Newm. Winnipeg, Man., July, 1909, (Wallis).
13. *Alloperla coloradensis* Banks. Banff, Alta., (Sanson).
13. *Alloperla imbecilla* Say. Banff, Alta., July 21, 1906, (Sanson).
14. *Nemoura perfecta* Walk. Toronto, Ont., (Walker).
16. *Leptophlebia cupida* Say. Go Home Bay, Georgian Bay, Ont., (W. A. Clemens).
17. *Leptophlebia nebulosa* Walk. Go Home Bay, Georgian Bay, Ont., (W. A. Clemens).
18. *Bactis propinquus* Walsh. Go Home Bay, Georgian Bay, and Toronto, Ont., (W. A. Clemens).
18. *Choeon dubium* Walsh. Go Home Bay, Georgian Bay, Ont., (W. A. Clemens).
19. *Siphlonurus alternatus* Say. Toronto, Ont., (Walker).
19. *Siphlonurus siccus* Walsh. Go Home River, Ont., (W. A. Clemens).
20. *Heptagenia canadensis* Walk. Go Home Bay, Georgian Bay, Ont., (W. A. Clemens).
20. *Heptagenia flavescens* Walsh. Winnipeg, Man., June 13, 1911, (Wallis); Go Home Bay, Ont., (W. A. Clemens).
20. *Heptagenia frontalis* Banks. Go Home Bay, Georgian Bay, Ont., (W. A. Clemens).
20. *Heptagenia tripunctata* Banks. Go Home Bay, Georgian Bay, Ont., (W. A. Clemens).
20. *Ecdyurus maculipennis* Walsh. Go Home Bay, Georgian Bay, Ont., (W. A. Clemens).

Neuroptera.

23. *Mantispa brunnea* Say. Thousand Islands, Ont., (Miss Coleman).
24. *Hemerobius canadensis* Banks. Banff, Alta., (Sanson).
24. *Hemerobius humuli* Linn. Winnipeg, May 13, 1911, (Wallis); Banff, Alta., Aug. 29, 1910, (Sanson); Toronto, Ont., (Walker).
24. *Hemerobius moestus* Banks. Sulphur Mt., Banff, Alta., on snow, Nov. 15, 1909, (Sanson).
24. *Hemerobius stigmaterus* Fitch. Toronto, Ont., (Walker).
25. *Boriomyia longifrons* Walk. Winnipeg, Man., July, 1909, (Wallis); Banff, Alta., on snow, Nov. 19, (Sanson).
25. *Boriomyia disjuncta* Banks. Winnipeg, Man., Sept. 12, 1911, (Wallis); Sulphur Mt., Banff, Alta., Aug. 17, 1908, (Sanson).
27. *Chrysopa chlorophana* Burm. Banff, Alta., (Sanson).
28. *Chrysopa oculata* Say. Banff, Alta., June 2, 1909, (Sanson).
28. *Chrysopa rufilabris* Burm. Toronto, Ont., (Walker).
28. *Chrysopa ypsilon* Fitch. Toronto, Ont., (Walker).

Tricoptera.

35. *Neuronia angustipennis* Hagen. Winnipeg, Man., June 24, 1910, (Wallis).
35. *Neuronia concatenata* Walk. Rosebank, Ont., (Hahn).
35. *Neuronia postica* Walk. Montreal, (Winn); Levis, Que., (Fyles).
35. *Neuronia stygipes* Hag. St. Hilaire, Que., May 24, 1910, (Winn).

36. *Limnephilus coloradensis* Banks. Winnipeg, Man., May 23, 1911, (Wallis).
36. *Limnephilus combinatus* Walk. Banff, Alta., Aug. 23, 29, 1911, (Sanson).
36. *Limnephilus luteolus* Banks. Banff, Alta., Aug. 10, (Sanson).
37. *Limnephilus submonilifer* Walk. Toronto, Ont., (Walker).
37. *Anabolia bimaculata* Walk. Banff, Alta., Aug. 5, 1908, July 28, 1911, (Sanson).
38. *Glyphopsyche irrorata* Fabr. Banff, Alta.,(Sanson).
38. *Pycnopsyche guttifer* Walk. Rosebank, Ont., (Hahn).
40. *Chilostigma alascensis* Banks. Banff, Alta., Oct. 14, 1910, (Sanson).
45. *Leptocerus ancylus* Vorhies. Winnipeg, Man., June 29, 1911, (Wallis).
45. *Triænodes grisea* Banks. Stony Mt., Man., Sept. 16, 1911, (Wallis).
47. *Hydropsyche scalaris* Hagen. Toronto, Ont., (Walker).

Odonata.

* *Coenagrion angulatum* Walker. Carduff, Sask., July 16, 1900, (Willing); Aweme, Man., July 4, 1905, (Criddle); Winnipeg Beach, Lake Winnipeg, June 19, 1909, (Wallis); Prince Albert, Sask., June 18, 1905, (Willing); Can. Ent., xliv., 259.

Sympetrum scoticum Don. Giant's Tomb Island, Georgian Bay, Ont., July 14, 1912, (Walker).

Sympetrum corruptum Hagen. Giant's Tomb Island, Georgian Bay, Ont., July 14, 1912, (Walker).

Erythrodiplax berenice Dru. East Bolton, Que., July 6, 1911, (Winn).

Araneida.

(Arranged according to Banks' Catalogue of Nearctic Spiders, U. S. N. M., Bulletin 72. The numbers refer to the pages in the catalogue.)

In *The Ottawa Naturalist*, Dec., 1895, a list of 100 species of spiders, occurring in Canada, determined by J. H. Emerton, appears, and in the same publication for Jan., 1896, J. B. Tyrrell adds records of the further distribution of 11 species included in above list. W. H. Harrington contributed, also in *The Ottawa Naturalist*, for April, 1896, and Jan., 1897, lists of Ottawa spiders, enumerating in all 76 species. Since the short lists which I included in the Entomological Records for 1908 and 1909, Dr. Banks has determined several collections of Canadian spiders, and the records mentioned below not only add considerably to our list, but extend our knowledge of the distribution of species mentioned in the papers above referred to. Those now added from Ottawa are not included in Harrington's lists.

7. *Zelotes atra* Hentz. Chelsea, Que., (Gibson); La Siene River, District of Rainy River, Ont., June, (W. McInnes).
8. *Herpyllus ecclesiasticus* Hentz. Winnipeg, Man., April 13, 1911, (Wallis).
8. *Pœcilochroa montana* Emerton. Winnipeg, Man., July 5, 1910, (Wallis).
9. *Gnaphosa gigantea* Keys. Husavick, Man., Aug. 29, 1910, (Wallis).
11. *Castianeira longipalpis* Hentz. Stony Mountain, Man., Aug. 10, 1910, (Wallis).
14. *Clubiona tibialis* Emerton. Treesbank, Man., July 17, 1910, (Wallis).
15. *Cœlotes calcaratus* Keys. Ottawa, April 20, (Gibson).

16. *Cybæus reticulatus* Simon. Mt. Ebbe, Pointe Warde, June 30, (collector unknown).
16. *Cybæus recticulatus* Simon. Metlakatla, B.C., (Keen).
16. *Agelena nævia* Walck. Stony Mountain, Man., Aug. 15, 1910, (Wallis).
16. *Tegenaria derhami* Scop. Ottawa, April 20, (Gibson); Winnipeg, Man., Oct. 5, 1911, (Wallis).
18. *Amaurobius bennetti* Blackwall. La Seine River, District of Rainy River, Ont., June, (W. McInnes).
19. *Amaurobius pictus* Simon. Metlakatla, B.C., (Keen); Inverness, B.C., July, (Keen); Mt. Ebbe Port Warde, June 30, (collector unknown); Bradfield Inlet and North River, May, (J. A. Cadenhead).
20. *Theridium sexpunctatum* Emerton. Metlakatla, B.C., (Keen).
20. *Theridium tepidariorum* Koch. Ottawa, Dec. 23, 1910, in a greenhouse, (Beaulne).
21. *Lithyphantes corollatus* Linn. Husavick, Man., Aug. 15, (Wallis).
21. *Steatoda borealis* Hentz. Husavick, Man., Aug. 15, (Wallis); Ottawa, May, 1907, (Gibson).
30. *Gongylidium perplexa* Keys. Metlakatla, B.C., (Keen).
32. *Labulla altioculata* Keys. Bradfield Inlet and North River, end May, (J. A. Cadenhead); Metlakatla, B.C., (Keen); Inverness, B.C., July, (Keen).
33. *Linyphia phrygiana* Koch. Treesbank, Man., July 28, 1910, (Wallis).
33. *Linyphia pusilla* Sundvall. Inverness, B.C., July, (Keen).
33. *Linyphia reducta* Keys. Metlakatla, B.C., (Keen).
33. *Linyphia rubrofasciata* Keys. Inverness, B.C., (Keen).
37. *Eugnatha straminea* Emerton. Winnipeg, Man., June 24, 1911, (Wallis).
37. *Tetragnatha extensa* Linn. Husavick, Man., July 11, 1910, (Wallis); Inverness, B.C., July, (Keen); Metlakatla, B.C., (Keen); Bradfield Inlet, Kahpto Range, 2.350 altitude, July 10, 1894, (J. A. Cadenhead); Pt. Warde, Mt. Ebbe, June 30 (J. A. Cadenhead); La Seine River, Lac des Mille Lacs, Ont., July, (W. McInnes).
37. *Tetragnatha laboriosa* Hentz. La Seine River, Lac des Mille Lacs, Ont., July, (W. McInnes); Treesbank, Man., July 17, 1910, (Wallis).
38. *Larinia borealis* Banks. Husavick, Man., Aug. 15, 1910, (Wallis).
39. *Cyclosa conica* Pallas. Treesbank, Man., July 17, 1910, (Wallis); La Seine River, Rainy River District, Ont., June 30, (W. McInnes).
39. *Zilla californica* Banks. Metlakatla, B.C., (Keen).
41. *Epeira californiensis* Keys. Metlakatla, B.C., (Keen).
42. *Epeira domiciliorum* Hentz. Husavick, Man., July 8, 1910, (Wallis).
43. *Epeira ocellata* Clerck. Bradfield Inlet and North River, end May, 1894, (J. A. Cadenhead); Metlakatla, B.C., (Keen); Husavick, Man., July 7, 1910, (Wallis).
44. *Epeira sericata* Clerck. Husavick, Man., July 2, 1910, (Wallis).
44. *Epeira thaddeus* Hentz. Treesbank, Man., July 17, 1910, (Wallis).
44. *Epeira trofolium* Hentz. Metlakatla, B.C., (Keen).
48. *Xysticus elegans* Keys. Treesbank, Man., July 17, 1910, (Wallis).
48. *Xysticus formosa* Banks. La Seine River, Lac des Mille Lacs, Ont., July, (W. McInnes).
48. *Xysticus gramineus* Emerton. Husavick, Man., July 5, 1910, (Wallis).
48. *Xysticus gulosus* Keys. Stony Mountain, Man., Aug. 10, 1910, (Wallis).

49. *Coriarachne versicolor* Keys. Winnipeg, Man., April 13, 1911, (Wallis).
50. *Misumena vatia* Clerck. Husavick, Man., July 3, 1910, (Wallis); Metlakatla, B.C., (Keen); Banff, Alta., (Sanson).
50. *Misumessus asperatus* Hentz. Winnipeg, Man., June 17, 1911, (Wallis).
51. *Thanatus lycosoides* Emerton. Winnipeg, Man., May 17, 1911, (Wallis).
51. *Tibellus oblongus* Walck. Husavick, Man., July 5, 1910, (Wallis).
52. *Philodromus inquisitor* Thorell. Husavick, Man., July 7, 1910, (Wallis).
52. *Philodromus pernix* Blackwall. Husavick, Man., Aug. 13, 1910, (Wallis).
52. *Philodromus rufus* Walck. La Seine River, Lac des Mille Lacs, Ont., July, W. McInnes).
53. *Dolomedes fontanus* Emerton. La Seine River, Rainy River District, Ont., June 30, 1890, (W. McInnes).
53. *Dolomedes sexpunctatus* Hentz. Husavick, Man., July 8, 1910, (Wallis).
54. *Pisaurina undata* Hentz. Winnipeg, Man., Sept. 10, 1910, (Wallis).
55. *Lycosa avida* Walck. Treesbank, Man., Aug. 2, 1910, (Wallis).
56. *Lycosa frondicola* Emerton. Treesbank, Man., July 28, 1910, (Wallis).
57. *Lycosa pratensis* Emerton. Husavick, Man., Aug. 29, 1910, (Wallis); La Seine River, Lac des Mille Lacs, Ont., July, (W. McInnis).
58. *Pardosa grœnlandica* Thorell. Nashvack, Labrador, Aug. 31, 1903, (A. Halkett); Fullerton, Hudson Bay, July, 1904, (A. Halkett); Winnipeg, Man., June 3, 1911, (Wallis).
59. *Pardosa lapidicina* Emerton. Husavick, Man., Aug. 29, 1910, (Wallis).
59. *Pardosa modica* Blackwall. Metlakatla, B.C., (Keen); Husavick, Man., July 8, 1910, (Wallis).
60. *Pardosa xerampelina* Keys. Husavick, Aug. 20, 1910, (Wallis).
61. *Trochosa rubicunda* Keys. Treesbank, Man., July 25, 1910, (Wallis).
61. *Pirata insularis* Emerton. Winnipeg, Man., June 24, 1911, (Wallis).
63. *Phidippus electus* Koch. Chelsea, Que., May 30, 1907, (Gibson).
66. *Dendryphantes octavus* Hentz. Winnipeg, Man., May 17, 1911, (Wallis).
68. *Pellenes falcata* Clerck. Treesbank, Man., July 23, 1910, (Wallis).
71. *Tutelina similis* Banks. Winnipeg, Man., June 17, 1910, (Wallis).

Acarina.

* *Macrocheles canadensis* Banks. Ottawa, from a guinea pig, (Hewitt); Proc. Ent. Soc., Wash., Vol. XIV., 98.

INDEX.

E. A. Schwarz

Forty-Fourth Annual Report

OF THE

Entomological Society

OF ONTARIO

1913

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO)

PRINTED BY ORDER OF

THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO:
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Printed By
WILLIAM BRIGGS
29-37 Richmond St. W
TORONTO

To His Honour Col. Sir John Morison Gibson, K.C.M.G., etc., etc., etc.,
Lieutenant-Governor of the Province of Ontario.

May it Please Your Honour:

The undersigned begs to present herewith, for the consideration of your Honour, the Report of the Entomological Society of Ontario for 1913.

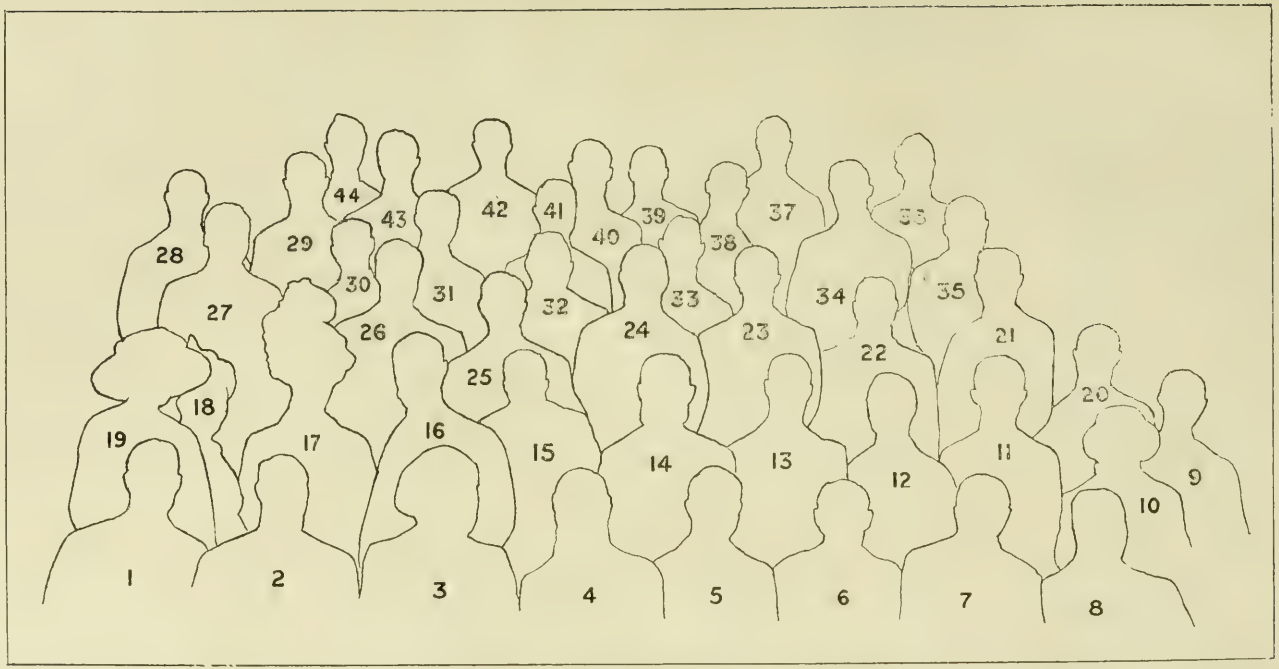
Respectfully submitted,

JAMES S. DUFF,

Minister of Agriculture.

Toronto, 1914.

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. Dr. 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. W. E. Saunders. 27. Dr. A. Cosens. 28. 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.

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FORTY-FOURTH ANNUAL REPORT

OF THE

Entomological Society of Ontario

1913

To the Honourable James S. Duff, Minister of Agriculture.

SIR,—I have the honour to present herewith the Forty-fourth Annual Report of the Entomological Society of Ontario.

The fiftieth Annual Meeting of the Society was held at Guelph on the 27th, 28th, and 29th of August, 1913, and was one of the most important occasions in the Society's history. It was attended not only by a large number of the Society's members, but also by many distinguished entomologists representing other societies and institutions in the United States and Great Britain.

The addresses and papers presented, together with the reports of the various officers and branches of the Society are embodied in the following pages.

The *Canadian Entomologist,* the Society's monthly organ, has now completed its forty-fifth volume, and continues to maintain its wide circulation and high scientific value.

I have the honour to be, Sir,

Your obedient servant,

EDMUND M. WALKER,

Editor.

Department of Biology,

University of Toronto.

Entomological Society of Ontario

OFFICERS FOR 1913-1914

President—C. Gordon Hewitt, D.Sc., F.R.S.C., Dominion Entomologist, Central Experimental Farm, Ottawa.

Vice-President—Mr. A. F. Winn, Westmount, Quebec.

Secretary-Treasurer—Mr. A. W. Baker, B.S.A., Demonstrator in Entomology, O. A. College, Guelph.

Curator—Mr. G. J. Spencer, Assistant in Entomology, O. A. College, Guelph.

Librarian—Rev. C. J. S. Bethune, M.A., D.C.L., F.R.S.C., Professor of Entomology and Zoology, O. A. College, Guelph.

Directors—Division No. 1, Mr. Arthur Gibson, Division of Entomology, Central Experimental Farm, Ottawa; Division No. 2, Mr. C. E. Grant, Orillia; Division No. 3, Mr. A. Cosens, Parkdale Collegiate Institute, Toronto; Division No. 4, Mr. C. W. Nash, East Toronto; Division No. 5, Mr. F. J. A. Morris, Peterborough; Division No. 6. Mr. R. S. Hamilton, Collegiate Institute, Galt; Division No. 7, Mr. W. A. Ross, Jordan Harbour.

Directors (Ex-Presidents of the Society)—Professor Wm. Saunders, C.M.G., LL.D., F.R.S.C., F.L.S., late Director of the Experimental Farms of the Dominion of Canada, Ottawa; Rev. C. J. S. Bethune, M.A., D.C.L., F.R.S.C., Guelph; W. Hague Harrington, F.R.S.C., Ottawa; Professor John Dearness, Vice-Principal Normal School, London; Henry H. Lyman, M.A., F.E.S., F.R.G.S., Montreal; Rev. Thomas W. Fyles, D.C.L., F.L.S., Ottawa; Professor Wm. Lochhead, B.A., M.S., Macdonald College, Que.; John D. Evans, C.E., Chief Engineer, Central Ontario Railway, Trenton; Professor Tennyson D. Jarvis, B.S.A., Ontario Agricultural College, Guelph; Professor E. M. Walker, B.A., M.B., University of Toronto.

Editor of "The Canadian Entomologist"—Prof. E. M. Walker, Toronto.

Delegate to the Royal Society—Mr. H. H. Lyman, Montreal.

Auditors—Professor J. E. Howitt, M.S.A., and Mr. L. Caesar, B.A., M.S.A., O. A. College, Guelph.

FINANCIAL STATEMENT

For the year ending October, 1913

Receipts.		*Expenditures.*	
Balance from 1911-12	$698 88	Cork and pins	$81 03
Members' fees	387 20	Printing	1,014 56
Advertisements	40 71	Expense	48 17
Government grant	1,000 00	Salaries	250 00
Sale reports and back numbers	208 74	Library	38 22
Sale cork and pins	63 10	Annual meeting	98 55
Jubilee meeting	28 36	Annual report	125 95
Bank interest	30 43	Jubilee meeting	197 90
		Bank exchange	3 95
		Balance on hand	599 09
	$2,457 42		$2,457 42

Respectfully submitted,

A. W. Baker,
Secy.-Treas.

Auditors { J. E. Howitt, L. Caesar.

PRESIDENTS ENTOMOLOGICAL SOCIETY OF ONTARIO

1863-4.....Professor Croft.
1864-5.....Wm. Saunders.
1865-8.....Rev. W. Hincks.
1868-71.....Professor Croft.
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1893-6.....W. Hague Harrington.
1896-8.....J. Dearness.
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1900-3.....Rev. T. W. Fyles.
1903-5.....Prof. Wm. Lochhead.
1905-7.....J. D. Evans.
1907-9.....Dr. Jas. Fletcher.
1909-10.....T. D. Jarvis.
1910-2.....Dr. E. M. Walker.
1912-3.....Rev. Prof. C. J. S. Bethune.

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1864-5.....Rev. W. Hincks.
1865-8.....Wm. Saunders.
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1903-5.....J. D. Evans.
1905-7.....Dr. Jas. Fletcher.
1907-9.....Tennyson D. Jarvis.
1909-10.....Dr. E. M. Walker.
1910-3.....Dr. C. Gordon Hewitt.

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1863-4.....Wm. Saunders.
1864-71.....Rev. C. J. S. Bethune.
1871-4.....E. Baynes Reed.
1874-5.....Jas. Williams.
1875-8.....J. H. McMechan.
1878-9.....Jas. Williams.
1879-81.....Jas. H. Bowman.
1881-8.....E. Baynes Reed.
1888-91.....W. E. Saunders.
1891-3.....W. E. Saunders and J. M. Denton.
1893-1901....W. E. Saunders and J. A. Balkwell.
1901-4.....W. E. Saunders and J. H. Bowman.
1904-6.....W. E. Saunders and J. A. Balkwell.
1906-8.....L. Caesar and Prof. S. B. McCready.
1908-11.....J. E. Howitt.
1911-3.....A. W. Baker.

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1863-5.....Jas. Hubbert.
1865-8.....Robert V. Rogers.
1868-9.....W. H. Ellis.
1869-72.....W. Osler.
1888-9.....Henry S. Saunders.
1889-1905....J. A. Moffat.
1905-7.....Rev. C. J. S. Bethune.
1907-9.....J. E. Howitt.
1909-12.....L. Caesar.
1912-3.....G. J. Spencer.

HONORARY MEMBERS ENTOMOLOGICAL SOCIETY OF ONTARIO

Honorary Members.	*Elected.*	*Died.*
1. Francis Walker, F.L.S., Assistant in the Entomological Department of the British Museum, Elm Hall, Wanstead, Essex, England.	Feb. 16, 1865.	Oct. 5, 1874. aged 65.
2. Ezra T. Cresson, Hymenopterist, one of the founders of the American Entomological Society, Philadelphia.	Nov. 10, 1868.	
3. William H. Edwards, Coalburgh, Kanawha Co., West Va., author of "The Butterflies of North America," and of a long series of papers in the "Canadian Entomologist."	Nov. 10, 1868.	Apl. 2, 1909, aged 87.

Honorary Members.	*Elected.*	*Died.*
4. Prof. Townend Glover, Entomologist to the Department of Agriculture, Washington, D.C.	Nov. 10, 1868.	Sept. 8, 1883, aged 70.
5. Augustus Radcliffe Grote, M.A., Buffalo, N.Y., Lepidopterist. Described a large number of new species and contributed for many years to the "Canadian Entomologist."	Nov. 10, 1868.	Sept. 12, 1903,
6. Dr. George H. Horn, Philadelphia, Pa., Coleopterist. Joint author with Dr. J. L. LeConte, of the "Classification of North American Coleoptera," and other works.	Nov. 10, 1868.	Nov. 24, 1897, aged 57.
7. Dr. A. S. Packard, Jr., Peabody Academy, Salem, Mass. Author of numerous works on systematic, technical and popular Entomology.	Nov. 10, 1868.	Feb. 14, 1905 aged 66.
8. Dr. C. V. Riley, Missouri; State Entomologist, chief of the United States Bureau of Entomology, Washington, D.C.	Nov. 10, 1868.	Sept. 14, 1895, aged 52.
9. Dr. S. H. Scudder, Boston, Mass. Author of "The Butterflies of Eastern United States and Canada," and of various works on Orthoptera, Fossil Insects, etc.	Nov. 10, 1868.	May 17, 1911, aged 74.
10. Dr. J. L. LeConte, Philadelphia, Coleopterist. Author of a large number of books and papers on systematic Coleopterology, and the describer of an immense number of species.	Nov. 10, 1868.	Nov. 15, 1883, aged 58.
11. Baron R. Von Osten Sacken, Russian Embassy, New York, Dipterist. Author of some of the earliest works on North American Diptera, published by the Smithsonian Institution.	Sept. 22, 1869.	May 20, 1906, aged 76.
12. Dr. Herman Hagen, Cambridge, Mass., Neuropterist, Director of the Museum of Comparative Zoology.	Sept. 22, 1869.	Nov. 9, 1893, aged 77.
13. Dr. Asa Fitch, the first State Entomologist of New York. Albany, N.Y.	Sept. 22, 1869.	Apl. 8, 1879, aged 70.
14. P. R. Uhler, Baltimore, Md., Hemipterist. For many years the chief authority on North American Hemiptera.	Sept. 25, 1873.	Oct. 21, 1913, aged 78.
15. V. T. Chambers, Covington, Ky.. Lepidopterist. An early contributor to "The Canadian Entomologist."	Sept. 25, 1873.	Aug. 7, 1883, aged 52.
16. Miss Eleanor A. Ormerod, LL.D., St. Albans, England. Pioneer worker in Economic Entomology in Great Britain, and authoress of a series of annual reports issued during more than twenty years.	Sept. 25, 1873.	July 19, 1901, aged 73.
17. Dr. L. O. Howard, Chief of the Bureau of Entomology. Washington, D.C.	Oct. 12, 1899.	
18. Prof. John B. Smith, Sc.D., State Entomologist of New Jersey, and Professor of Entomology in Rutgers' College, New Brunswick, N.J.	Oct. 12, 1899.	Mch. 12, 1912, aged 54.
19. Prof. F. M. Webster, Wooster, Ohio. In charge of investigations regarding insects attacking cereal crops, Bureau of Entomology, Washington. D.C.	Oct. 12, 1899.	
20. Prof. H. F. Wickham, M.A., Coleopterist, Professor of Entomology, Iowa State University, Iowa City, Iowa.	Oct. 12, 1899.	
21. Dr. Wm. A. Ashmead, Hymenopterist. Author of many papers on the order. U.S. National Museum, Washington, D.C.	Oct. 27, 1904.	Oct. 17, 1908, aged 53.

Honorary Members.	*Elected.*	*Died.*
22. Prof. T. D. A. Cockerell, Hymenopterist. Author of numerous papers on Coccidae. Apidæ, and Fossil Insects. University of Colorado, Boulder, Colorado.	Oct. 18, 1905.	
23. Prof. J. H. Comstock, Author of the "Manual for the Study of Insects." "The Spider Book," etc., Cornell Univirsity, Ithaca. N.Y.	Nov. 23, 1911.	
24. Dr. E. P. Felt, State Entomologist of New York, Albany, N.Y.	Nov. 23, 1911.	

LIFE MEMBERS

1. Dr. William Saunders, C.M.G., LL.D., F.R.S.C., Director of the Experimental Farms of the Dominion.—October 20, 1886.
2. Rev. C. J. S. Bethune, M.A., D.C.L., F.R.S.C., Professor of Entomology, Ontario Agricultural College, Guelph.—November 3, 1910.
3. Edmund Baynes Reed, Director of the Meteorological Station, Victoria, B.C.—November 23, 1911.
4. Rev. Thomas W. Fyles, D.C.L., former President of the Society and of the Quebec Branch, Ottawa.—August 28, 1913.

LIST OF MEMBERS

Ontario.

Astwood, J. C. .....Port Arthur.
Auden, K. F. .....Toronto.
Baker, A. W.....Guelph.
Beaulieu, Germain .....Ottawa.
Beck, H. P. .....London.
Bethune, Prof. .....Guelph.
Bicknell, H. E. .....Toronto.
Brimley, J. F. .....Grimsby.
Bock, H. P. .....London.
Burrows, A. R. .....Guelph.
Caesar, L. ..... "
Calvert, E. N. ..... "
Calvert, J. F. .....London.
Clemens, W. A.....Toronto.
Craigie, E. H. ..... "
Cosens, A. ..... "
Curran, H. ..... Guelph.
Dearness, J. ..... London.
Doherty, T. K. ..... Ottawa.
Duff, G. H. .....Toronto.
Duncan, R. S. .....Port Hope.
Dunlop, James .....Woodstock.
Evans, J. D. .....Trenton.
Fyles, Rev. Dr. .....Ottawa.
Germain, Bro. ..... "
Gibson, Arthur ..... "
Good, C. A. .....Guelph.
Grant, C. E. .....Orillia.
Hahn, Paul .....Toronto.
Haight, D. H. .....Sudbury.
Harkness, D. .....Jordan Harbor.
Harrington, W. H. .....Ottawa.
Hewitt, Dr. C. G. ..... "
Howitt, Prof. J. E. .....Guelph.
Hudson, H. F. .....Ottawa.
Inglis, John .....Hamilton.
Jackson, V. .....Toronto.
Kilman, A. H. .....Ridgeway.
Kitto, V. .....Ottawa.
Logier, W. .....Toronto.
Morden, A. .....London.
Morris, F. J. A. .....Peterboro.
McCready, S. B. .....Guelph.
McKechnie. J. B. .....Toronto.
Nash, C. W. ..... "
Noble, J. W. .....London.
Patterson, A. M. .....Toronto.
Petch, C. E. .....Ottawa.
Prewett, F. J. .....Toronto.
Ross, W. A. .....Jordan Harbor.
Sanders, G. E. .....Ottawa.
Saunders, Dr. Wm. .....London.
Saxby, W. .....Toronto.
Sladen, F. W. L. .....Ottawa.
Smith, A. .....Toronto.
Snazelle, Charles ..... "
Spencer, G. .....Guelph.
Strickland, E. H. .....Ottawa.
Tanner, Harold .....Stratford.
Thompson, W. R. .....London.
Tomlinson, Robert .....Toronto.
Tothill, J. D. .....Ottawa.
Walker, Dr. E. M. ..... Toronto.
Ware, Thomas .....Paris Station.
Washington, L. P. .....Hamilton.
Watson, Dr. A. H. R. ....Port Hope.
White, James .....Snelgrove.
Williams, J. B. .....Toronto.
Wood, S. T. ..... "
Wright, W. H. .....Guelph.

Quebec.

Agricultural Editor, *Weekly Witness* .....Montreal.
Barwick E. C. ..... "
Brainerd, Dwight ..... "
Burgess, T. J. W. ..... "
Chagnon, G. ..... "
Clayson, G. H. ..... "
Dunlop, G. C. ..... "
Du Porte, E. Melville....Macdonald College.
Earby, A. .....Montreal.

QUEBEC.

Greene, L. R. .....Montreal.
Huard, Rev. V. A. .....Quebec.
Lochhead, Prof. .....Macdonald College.
Lyman, H. H. .....Montreal.
Moore, G. A. ..... "
Norris, A. E. ..... "
Southee, G. A. ..... "
Tourchot, A. L. .....St. Hyacinthe.
Winn, A. F. .....Montreal.

ALBERTA.

Baird, Thomas .....High River.
Bentley, Lettice .....Lethbridge.
Dod, F. H. Wolley, ...Midnapore.
Kain, V. L. .....Edmonton.
Moody, Miss .....W. Calgary.
Whitehouse, F. C. .....Red Deer.

MANITOBA.

Criddle, Norman .....Treesbank.
Heath, E. F. ..... Cartwright.
Hone, R. .....Manitou.
Hunter, Dr. A. J. .....Teulon.
Wallis, J. B. .....Winnipeg.

NOVA SCOTIA.

Allen, E. C. .....Yarmouth.
Brittain, W. H. .....Truro.
Gooderham, C. B. ..... "
MacKay, Dr. A. H. .....Halifax.
Payne, H. G. .....Granville Ferry.

NEW BRUNSWICK.

Vroom, J. .....St. Stephen.

SASKATCHEWAN.

Androchowicz, E. .....Humboldt.
Neville, S. J. .....Cottonwood.
Willing, Prof. T. N. .....Saskatoon.

BRITISH COLUMBIA.

Abbott, R. C. .....Mission City.
Abbs, A. W. .....Vancouver.
Abriel, T. .....Nakusp.
Anderson, E. M. .....Victoria.
Anderson, J. R. ..... "
Bain, T. H. .....N. Vancouver.
Barnhill, E. .....Kelowna.
Bird, M. .....Vancouver.
Blackmore, C. .....Victoria.
Boncquet, A. .....Vancouver.
Brand, James ..... "
Brealey, A. .....Hatzic.
Bryant, T. .....Ladysmith.
Brydon, J. .....Victoria.
Bush, A. H. .....Vancouver.
Chapman, C. ..... "
Clark, R. ..... "
Cockle, J. .....Kaslo.
Collins, H. .....Grand Forks.
Crease, H. .....Kelowna.
Croker, A. .....Victoria.
Cunningham. T. .....Vancouver.
Davidson, T. ..... Vancouver.
Davidson, J. ..... "
Day, G. O. .....Vancouver Is.
Garraway, H. L. .....Vernon.
Gavet, D. .....Vancouver.
Getchell, F. H. .....Vancouver.
Hadwen, Dr. S. .....Mt. Lehman.
Hanham, A. W. .....Duncans Station.
Harvey, R. V.....Victoria.
Hill-Tout, W. S. .....Abbotsford.
Hoy, B. .....Vernon.
Hunt, E. C. .....Creator.
James, F. T. .....Victoria.
Kendall, J. B. ..... Vancouver.
Kennedy, A. B. ..... "
Lang, W. A. .....Peachland.
Lyne, W. H. .....Vancouver.
Marmont, L. E. .....Fraser Mills.
Marriott, E. G. .....Cranbrook.
McHardy, C. F. .....Nelson.
Mengens, Mr. .....Kelowna.
Middleton, M. .....Nelson.
Nicolle, W. ..... "
Norman, P. .....Victoria.
Palmer, R. M. .....Kamloops.
Patch, A. M. ..... Vancouver.
Peters, R. .....Victoria.
Pooley, W. R. .....Kelowna.
Reed, E. Baynes .....Victoria.
Reeves, S. H. .....Duncans.
Robertson, W. H. .....Victoria.
Ross, A. H. .....Nelson.
Rowland, A. .....Vancouver.
Ruhman, M. .....Vernon.
Russell, M. W. .....Kelowna.
Scott, W. E. .....Victoria.
Sherman, R. S. .....Vancouver.
Simons, A. E. ..... "
Simms, A. C.....Summerland.
Skinner, E. M. .....Victoria.
Stanton, T. H. .....Duncans.
Taylor, L. E. .....Kelowna.
Thomson, C. .....W. Summerland.
Treherne, R. C. .....Vancouver.
Venables, E. P. .....Vernon.
De Verteuil, Dr.....Vancouver.
Wallace, E. A. .....Victoria.
Wilkerson, G. E. ..... "
Wilson, R. M. .....Vancouver.
Winslow, R. M. .....Victoria.
White, E. A. .....Sardis.
Woods, Mrs. E. A.....Grand Prairie.

HONORARY MEMBERS.

Cockerell, Prof. T. D. A. ..Boulder, Col.
Comstock, Prof. J. H. ....Ithaca, N.Y.
Cresson, Ezra T. .....Philadelphia, Pa.
Felt, Dr. E. P. .....Albany, N.Y.
Howard, Dr. L. O.....Washington, D.C.
Webster, Prof. F. M. ..... "
Wickham, Prof. H. F.....Iowa City, Iowa.

LIFE MEMBERS.

Saunders, Dr. Wm. .....London.
Late Director of the Experimental Farms of the Dominion.
Bethune, Rev. C. J. S.....Guelph.
Professor of Entomology, Ontario Agricultural College.
Fyles, Rev. Dr. T. W.....Ottawa.
Reed, E. Baynes.....Victoria.
Director of the Meteorological Station.

The Entomological Society of Ontario

ANNUAL MEETING

The Fiftieth Annual Meeting of the Society was held at the Ontario Agricultural College, Guelph, on Wednesday, Thursday and Friday, Aug. 27th, 28th and 29th, 1913, and was one of the most important events in the history of the Society.

The President, Rev. Dr. C. J. S. Bethune, though present at all the meetings was unfortunately unable to act in his official capacity on account of defective eyesight. His place in the chair was ably filled by the Vice-President, Dr. C. Gordon 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. William Saunders, one of the original founders of the Society, whose serious illness prevented him from attending the meetings, as had been expected.

The following were present at the meeting: Prof. J. H. Comstock, Hon. Member, Entomological Dep't., 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.; Mr. 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, Que. Soc. for the Protection of Plants; Mr. John D. Evans, Trenton, Ont.; 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; Mr. J. F. Brimley, Grimsby; Messrs. Arthur Gibson, and F. W. L. Sladen, Division of Entomology, Ottawa; the following field agents of the Dominion Division of Entomology: Messrs. Sanders, Tothill, Petch, Ross, Hudson, McLaine; Mr. 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, Mr. Wright, Mr. E. J. Zavitz, G. J. Spencer; Messrs. Burroughs, Curran, Good, Hart and others.

On Wednesday morning 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 sanctioned at the general meeting, have been included in the copy of the constitution of the Society which appeared in the December number of the Canadian Entomologist.

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, after which the congratulatory addresses from the representatives of other societies and institutions were presented.

ADDRESS OF WELCOME.

Dr. G. C. Creelman, President of the Ontario Agricultural College, in a most genial and hearty manner welcomed the members of the Society and the visitors from other lands. He then went on to say:

I see a number of men who were formerly students at this College, now working in different Provinces of the Dominion of Canada. We are delighted to have these men come back to the old college and Province of Ontario, and to the Entomological Society. We are pleased to see so many strong men who have done actual work on our farms. We have been able through our Department of Entomology to give out a large amount of information to the farmer, which he was otherwise unable to get by himself. That would be a good definition for a college: "A place where people are taught things that cannot be taught at home." What you men can do in entomology, etc., farmers are incapable of doing for themselves.

I want to pay a tribute to the scientific men throughout the length and breadth of this and other lands at the present time—the men who have helped agriculture. The farmer usually has been a hewer of wood, as there has been so much necessity for manual labor on the farm; and he has not had time to work out the life histories of the various injurious insects. You have done it for him, and prescribed the remedy, until now by putting down his name, he can get by mail free the thing that is necessary to kill the injurious things on his farm. You have experimented, you have tried it and the farmer gets the results of your labors, at home. It is not always appreciated, even the agricultural press is inclined at times to tell them not to have too much of it; but I think more and more that the scientific man, and the entomologist in particular, is beginning to come in to his own.

I hope to see all here to-night at a reception to be given by Mrs. Creelman and myself at our residence.

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.

Fig. 1.—Showing remarkable quantity of silk spun by Forest Tent Caterpillars, in moving from tree to tree (original).

REPORTS ON INSECTS OF THE YEAR.

Division No. 1, Ottawa District—Arthur Gibson, Central Experimental Farm, Ottawa.

Unlike the season of 1912, that of 1913 in the Ottawa District was bright, clear, with little rainfall, and in the summer a long continued drought which reduced very considerably hay, corn, roots and other crops. Such a season, of course, was favourable for the development of insect life and some serious outbreaks of well-known forms took place.

Insects Attacking Field Crops.

Locusts. These insects were abundant in large numbers near Ottawa, particularly in light sandy districts. At Bowesville, about six miles from Ottawa swarms of them were present in oat, barley, timothy, and corn fields, and much damage was effected. Potatoes and beans were also attacked. In August an investigation was made of some of the fields where the locusts were present in thousands, and much destruction was seen. The species chiefly responsible for the damage was the Lesser Migratory Locust, *Melanoplus atlanis*. The Pellucid Locust, *Camnula pellucida*, was the other species present which was doing damage, but this was in much smaller numbers than *M. atlanis*. In some fields poisoned bran had been spread, and while large numbers of the insects were killed, the attack was not by any means stopped. The poisoned bran had been applied after the locusts had acquired their wings. Better results, of course, would have been secured if the application had been made during the hopping stage.

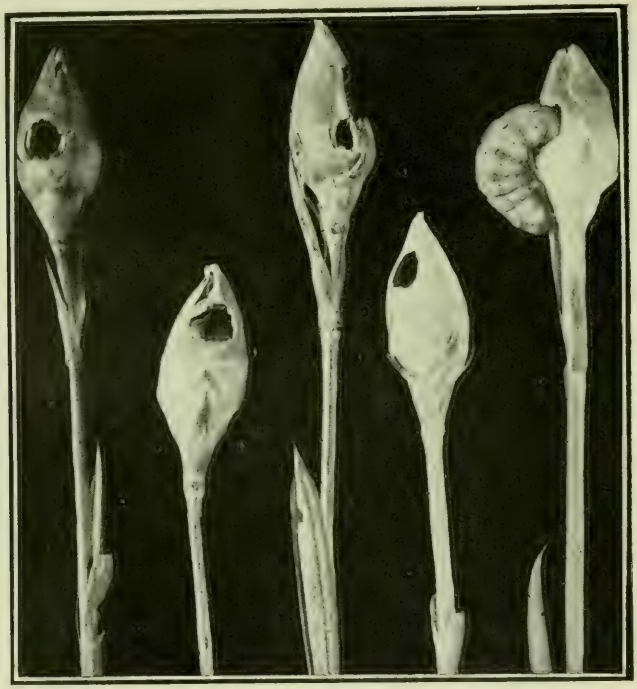

Fig. 2.—Carnation buds eaten out by Variegated Cutworm (original).

Root Maggots. These insects were again prevalent throughout the district. The Cabbage, or Radish Root-Maggot, was frequently complained of as attacking cauliflowers, cabbages, radishes and turnips. The Onion Maggot, also, did considerable damage, but no report of the work of the Seed-corn Maggot was received.

Other common pests, such as Cutworms, Flea-beetles, and White Cabbage Butterfly were present in destructive numbers.

THE BURDOCK BORER (*Papaipema cataphracta*). Several reports were received of a borer in the stems of tomato, and from specimens collected and received the species was seen to be that which I have commonly called the Burdock Borer, owing to this plant being the favourite food of the larvæ in the Ottawa District. The presence of this borer in tomato, potato, or other plants is usually detected by the unhealthy appearance of the plants, the tops becoming withered and falling down on one side. Cutting off the portion of the plants containing the caterpillar is the only remedy that can be suggested.

ATTACKING FRUIT TREES.

TENT CATERPILLARS. Both species, the American Tent (*Malacosoma americana*) and the Forest Tent (*Malacosoma disstria*) were present in large numbers throughout the district. Apple trees were entirely stripped of foliage, and in many orchards little fruit was gathered. At the Central Experimental Farm where the trees had been regularly sprayed, good crops of apples were secured.

WOOLLY-APHIS-OF-THE-APPLE (*Schizoneura lanigera*). This insect is conspicuously present in some orchards in the district at the present time, and requests have been received for a remedy. Fortunately we have not received any report of injury by the root-infesting form.

THE CODLING MOTH (*Carpocapsa pomonella*) was again present in injurious numbers, as was also the OYSTER-SHELL SCALE (*Lepidosaphes ulmi*). In last year's report I mentioned the occurrence at Ottawa of the adult of the Apple Maggot (*Rhagoletis pomonella*). I am glad to state that no further evidence of the presence of this destructive insect has been seen during the present year.

ATTACKING FOREST AND SHADE TREES.

The chief destructive caterpillar of 1913 was the FOREST TENT CATERPILLAR (*Malacosoma disstria*). During the seasons of 1911, 1912, and 1913 the district of Ottawa has been visited by remarkable outbreaks of the Forest Tent Caterpillar. Miles of forest trees—poplar, birch, maple, etc.—have been stripped bare by the hordes of caterpillars. The outbreak of 1913, however, was not so widespread as that of 1912. As mentioned in my report presented at the last annual meeting of the Society, trains on the Gatineau service of the Canadian Pacific Railway were stopped repeatedly owing to the large numbers of larvæ present on the tracks. This only happened once or twice during the present season. On a part of the grounds of the Central Experimental Farm where several trees were entirely denuded of foliage, conspicuous paths of silk were spun by the larvæ in moving from tree to tree. The photograph reproduced herewith which illustrates remarkably well the quantity of silk spun by the caterpillars was taken by Mr. J. S. Wallace, of the Dominion Observatory. At the time the photograph was taken the larvæ were about a quarter of an inch long. Large numbers of eggs had been deposited on pine and even cedar trees close to an electric arc street light, and when the young larvæ hatched they soon left these trees and made the silken pathways, chiefly towards the large mountain ash tree, standing in the background of the illustration. (See p. 15.)

In 1912 the first moths did not emerge until early in July and the vast numbers not until the middle of the same month. In the present year (1913)

moths were noticed in numbers at Britannia, near Ottawa, on June 27th; on June 29th thousands were present around the arc lights in Ottawa and flights were also observed in early July.

During the winter of 1912-1913 the eggs of this species were present in countless thousands on shade trees in the streets of Ottawa. During spring and early summer it was an unusual sight to see the large numbers of these trees which had been banded with ordinary tanglefoot fly paper. At the present time there are plenty of eggs on the trees in Ottawa, but fortunately they are not nearly so abundant as they were a year ago.

Attacking Greenhouse and Garden Plants.

The Bordered Sallow (*Pyrrhia umbra*). The caterpillars of this noctuid moth, which are green, spotted with black, have the habit of eating into buds of roses and other garden plants. During the past season roses particularly were reported as being injured.

Root-Infesting Aphid. Several complaints were received of an aphis attacking the roots of asters. One complaint reached me on Aug 7th which stated that whole plots of asters had been destroyed in some gardens in Ottawa. Asters on the grounds of the Experimental Farm were also injured apparently by the same species.

Red Spider. In dry seasons, such as that of 1913, the so-called red spider is usually very prevalent. During the past season very serious injury was caused by these mites to a large number of different kinds of garden plants, particularly sweet peas. The injury was very apparent in the middle of August.

Cutworms in Greenhouses. Occasionally we receive reports of injury by cutworms in greenhouses. One of the most interesting of these which has come to my notice, occurred in the carnation house of one of our Ottawa florists. During the winter when the injury was noticed I visited the greenhouse and found that the species responsible for the damage was the Variegated Cutworm (*Peridroma saucia*). Practically the only injury was to the buds which were in many instances entirely eaten out during the night by the caterpillars, as shown in the photograph reproduced herewith (Fig. 2). Cutworms in greenhouses can easily be controlled by scattering poisoned bran wherever they occur.

Division No. 3, Toronto District—A. Cosens.

The season of 1913 should go on record as a very favourable one for collecting. Long spells of fine weather, broken only for short intervals by occasional showers have characterized the summer. The autumn has been exceptionally warm, and insect activity has been correspondingly prolonged. A Mourning Cloak butterfly (*Vanessa antiopa,* L.) had sufficient energy to flutter about in the enjoyment of the warm sunshine of November 3rd, and numerous Crane Flies (*Trichocera maculipennis,* Fabr.) were still zig-zagging in the smoky air on November 13th.

The Tussock Moth was much more plentiful in Parkdale this season than it has been any previous one. The cocoons were formed even in crevices of the foundations of houses and under stone window sills; besides such unlikely places they were plentiful along the fences, and in some trees they were literally massed at the axils of the branches. If this species were not extensively parasitized the

introduction of suitable parasites would be considered the proper solution of the problem, and a campaign might be suggested similar to that being carried on at present against the Gypsy and Brown-Tail Moths. Since the natural check is already firmly established, care should be taken to assist, not to counteract it, by the artificial means used to bring the pest under control.

Until this season I have not been successful in breeding *Saperda concolor,* Lex., from its galls, although I have collected swellings on the stems of poplar and willow with the utmost confidence on several previous occasions. The galls from which the beetles were finally secured occurred on the stems of *Populus balsamifera,* L.. usually on small second-growth material. The swellings were ellipsoidal to spherical in form, and averaged about 2 cm. in length, the width varying with the size of the affected branch. The tunnels of the larvæ were on an average 15 mm. in length by 4 mm. in diameter and passed almost straight along the centre of the stem. In external form the gall closely resembles that produced on *Populus tremuloides,* Michx., by the Clear-wing Moth, *Memythrus tricinctus,* Harris. The beetles emerged early in May. In the locality where found the galls were abundant enough to seriously damage the smaller specimens of the host. Judging from my experience with this beetle a number of the swellings on poplar and willow commonly ascribed to it must derive their stimulus from other sources probably bacterial or fungal in character.

Another interesting gall not previously reported from this locality is that produced on various species of poplar by the moth *Ectoedemia populella,* Busck. I collected this gall several years ago on *Populus deltoides,* Marsh., growing in the scanty soil of a small rocky island near Hutton House, Muskoka, but did not obtain it at Toronto until the present season. It is here found on *Populus grandidentata,* Michx. The gall has not the spindle shape that we commonly associate with the Lepidopterous type, but is nearly globular in form. It originates by a swelling of the petiole of the leaf close to its junction with the blade.

The following list includes all the other Lepidopterous gall producers, as far as reported from this vicinity:

Ecdytolopha insiticiana, Zeller.
Host, *Robinia pseudo-acacia,* L.

Eucosma scudderiana, Clemens.
Hosts, *Solidago canadensis,* L.
" *serotina,* var. *gigantea,* Gray.

Gnorimoschema gallaesolidaginis, Riley.
Hosts, *Solidago canadensis,* L.
" *serotina,* var. *gigantea,* Gray.
" *rugosa,* Mill.

Gnorimoschema gallaeasterella, Kellicott.
Hosts, *Solidago latifolia,* L.
" *caesia,* var. *axillaris,* Gray.

Memythrus tricinctus, Harris.
Host, *Populus tremuloides,* Michx.

Stagmatophora ceanothiella, Cosens.
Host, *Ceanothus americanus,* L.

Complaints from amateur rose-growers, early in the season, led to an examination of several dead stalks from rose bushes. In almost every case a row of larvæ was found occupying the pith. These were arranged with surprising regularity, each one occupying nearly the same space and separated from the next by only a thin partition. The moths that emerged from the affected twigs proved to be *Ceratophorus tenax,* Fox. Concerning this species S. A. Rohwer writes: "As a rule it cannot be classed as an injurious insect, as it attacks twigs which have been pruned, in preference to making its own holes, and pruned twigs can be treated by painting the end with almost any kind of paint, or putting a small tack down the pith."

Leaves on *Populus grandidentata,* Michx., slightly rolled from one edge towards the midrib and almost parallel to it were found to contain larvæ of a sawfly. These pupated in the soil of the breeding jar and emerged about the middle of July. The species were found to be *Pontania populi,* Marlatt. The identification of this and the preceding species I owe to the kindness of S. A. Rohwer, Washington.

This season has been a suitable one for the production of aphids. On the American Elm numerous clusters of leaves rolled and massed together indicate the activity of *Schizoneura americana,* Riley, while along frost cracks and other breaks in the superficial tissues frequent lines and masses of white pubescence show that *Schizoneura rileyi,* Thomas, has there found favourable places for the establishment of colonies. The many specimens of Scotch Elm, *Ulmus glabra,* Huds., furnish a host for a distinct form of aphid. The individual leaves are rolled from one side in this case, and the part included in the roll is distinctly lighter in colour. For several years a large number of leaves have fallen in July and August from our Norway Maples, *Acer platanoides,* L. This has been particularly well marked this season. When the leaves are examined small colonies of plant lice are found along the line of the midrib and the principal veins. The larvæ are light green in color, but the adults, while still retaining the green as a ground color, are distinguished by a comparatively wide, red, median band on the thorax and a V-shaped one on the abdomen, the open part of the V pointing forward. The "honey-dew" from the aphids gives the leaves a varnished appearance and often is so plentiful as to drip from them to the sidewalk. *Populus grandidentata,* Michx., is attacked in a similar way by a closely related species of aphid, but in this case the leaves do not become detached from the tree.

The larvæ of the following moths were common this season on the hosts indicated:—

Archips fractivittana, Clemens.—Host, Crataegus.—The larva draws several leaves of the host together with silk threads and feeds within the shelter thus formed.

Acleris fractivittana, Clemens.—Host, a cultivated Double-white Lilac.—The leaves are drawn together by the larva as in the preceding species.

Pyrausta sp., near to or *thestealis,* Walker.—Host, *Corylus rostrata,* Ait.—The larva rolls up single leaves along a line almost parallel to the midrib.

Anacampsis populella, Clemens.—Host, *Populus grandidentata,* Michx.—Single leaves of the host are rolled up as in the preceding species.

Acleris heindelana, Fernald.—An inquiline in the gall formed by *Rhabdophaga rhodoides,* Walsh, on *Salix humilis,* Marsh. This moth avails itself of leaves already massed by the stimulus of the gall producer, and thus escapes the

necessity of drawing them together with silk threads. A larger and darker form, bred from leaves of *Salix cordata,* Muhl., that had been drawn together, has been identified as probably the same species. If the examination of more material substantiates this concluson, it shows the inquilinous habit is not firmly established.

For the identification of the above Lepidopterous forms I am indebted to August Busck, Washington, D.C.

DIVISION NO. 5, PORT HOPE.—F. J. A. MORRIS, PETERBOROUGH.

1. ECONOMIC ENTOMOLOGY.—This last season the Tent Caterpillar was prevalent and did great damage to foliage. The prolific "nursery" for this creature seems to be the wild shrubs and trees of cherry and kindred species bordering farm, fields and woodlands. Such trees and shrubbs are abundant, and are universally neglected by the farmers. From them comes the supply that eventually makes its way into neglected orchards and causes such unsightly havoc to the foliage. This season the newly-hatched larvæ were observed at work early in May destroying the buds before the leaves unfolded. They were specially abundant north of here, from five to thirty miles north of Lake Ontario, *e.g.,* Bethel, Garden Hill, and Peterborough. In June they had stripped the trees in some abandoned orchards entirely bare, and larvæ nearly full-grown had spread (in search of food) to adjoining lanes and woodlands. Specimens of the American Tent Caterpillar were as common in a hardwood bush between Garden Hill and Carmel as those of the Forest Tent Caterpillar, and were found—shortly before pupation—thriving on the leaves of maple, oak, basswood, birch, and hazel. If it became the practice among farmers to exterminate from their fence borders all cherry, hawthorn, and other kindred seedlings and shrubs, or at least to burn off the webs early in May, this would go a great way towards stopping the pest at its source.

In some of the gardens about town complaints were heard of a larva eating dahlia buds. Some of the shade trees in residential quarters were badly disfigured by "blight"—the work of the cotton-tail louse. Both species of asparagus beetles were more abundant than ever in the district, and were found on wild plants several miles distant from the town as well as in cultivated crops, but apparently the damage caused by the insect is trivial. The "railroad" worm was almost absent, a reaction after the extraordinary prevalence of three and two years ago; the potato beetle, also, was conspicuous by its absence.

Another pest very noticeable this year was the aphis. Nasturtiums were infested by a black aphid which so weakened the plants that after the drought began in the middle of July the foliage shrivelled and died. In apple orchards much havoc was wrought by a green aphid. It attacked the foliage and fruit and so weakened vitality that trees hitherto good bearers produced nothing but bunches of small clustered apples which failed to mature; moreover, of those that ripened normally many were spoiled for market by their appearance, being stained and streaked with a dark secretion from the insect. Unfortunately, well-kept orchards suffered most from these tiny epicures. Mr. Duncan, of the Department of Agriculture, estimated the loss in a ten-acre orchard of his own at above $150. He used with good results a kerosene emulsion; another remedy is a tobacco preparation known as "Black Leaf 40."

The "white grub," responsible for much local damage in recent years was less prevalent in 1913, though some reported loss to potato and grass crops due to this larva of the June beetle.

2. Juvenile or Amateur Entomology.—Through Mr. Duncan's energies great activity obtains among the school children in making collections of various kinds. In addition to the usual inducements for pupils to make collections of weeds, seeds, etc., for exhibit at show fairs in the fall, prizes were offered for exhibits showing the work and life history of various insect pests. There were also prizes offered for collections of insects beneficial and injurious. This has been the custom for some years in our district, but the exhibits were more numerous and better this year than ever before. For instance, the exhibitor who carried off first prize in 1911 and 1912 entered the lists to compete with the prize collection of 1911 and 1912 augmented by specimens taken in 1913 and yet failed to get even a third place. Altogether, there were eight collections at the Port Hope Show Fair and six at the Millbrook, besides eight and seven respectively at the two rural show fairs for South Hope and Cavan, the one held in Welcome and the other at Whitfield. Some exhibits were entered at two fairs, but altogether more than twenty different collections of insects were judged. Many of these were quite extensive, representing several orders of insects, and the best exhibits showed skill in mounting, as well as care and taste in arranging.

Adult collectors generally complain that the season of 1913 was a bad one for the enthusiast. In Coleoptera neither Dr. Watson nor your District Director made many captures worthy of note, as new or rare. In Lepidoptera we have two very active collectors in Mr. Charles Mann and Mr. H. L. Bowers of the Standard Ideal Company. The latter, especially, is a fine entomologist and has sent several most interesting batches of Lepidoptera to Mr. Evans, of Trenton, for identification. He reports the season as disappointing:

"All butterflies and most of our locally common moths were scarce. *Anosia plexippus,* Linn., common in 1912, occurred hardly at all. Our representatives of the *Argynnis* family, which in 1912 appeared to reach a numerical zenith, fell to the nadir in 1913. This observation applies also to *Brenthis, Phyciodes, Satyrus, Vanessa, Grapto, Papilio,* and *Colias. Pieris rapae* was abundant as usual, and *protodice* was taken several times. *P. napi* remains constant in restricted localities.

"Interesting takes were *Phyciodes batesi,* Reak; *Cœnonympha inornata,* Edw.; *Amblyscirtes samoset,* Scudd.; *Thecla acadica,* Edw.; *T. liparops,* B. and L.; *T. niphon,* Hubn.; *Colias interior,* Edw.; *Papilio ajax.*

"Sugaring, the electric lights, and a light-trap were all comparative failures, though in 1912 they had been very successful, the last-named method especially in microlepidoptera.

"In the fall of 1912 moths of *Malacosoma americana* were extremely abundant. 1913 showed the result in that practically every haw and wild cherry tree had from one to five nests. Some means should be taken to cut off this supply furnished by wild food-plants. Moths of the cut-worm family were scarce; also those of the woolly-bear group. Very few of the fall web-worm were taken. Leaf-rollers, usually abundant, were scarce. Spring and fall canker-worms are not numerous about Port Hope. The abundance of *Celerio intermedia* was noticeable. Some 50 caterpllars were taken from a small patch of *Epilobium actinocaulon.* Tomato-hawks were scarce. As said before, the year was a failure from a collector's standpoint. With the exception of the tent-caterpillars, I do not know of any Lepidopterous larvæ that have caused serious depredations."

Mr. Bowers closes his letter with a list of over twenty interesting captures made this season. His list is on file, but is withheld owing to probable exigencies of space.

Division No. 7. Niagara District—W. A. Ross, Jordan Harbour.

Insects of the Year. As I was absent from the Niagara District during the greater part of 1913, I am not in a position to do justice to a report on "Insects of the Year in Division 7," and so in place of the customary report I shall present brief notes on some insects which were of particular interest to me this past season.

Orchard Pests.

Apple Maggot (*Rhagoletis pomonella*). This insect was remarkably scarce last summer in most sections of Ontario. In orchards which were badly infested two and three years ago I had often to search quite diligently to secure a few adults. It will undoubtedly interest the members of the Society to learn that the Apple Maggot may remain in the soil in the pupal stage for two years. During the month of July, five females and four males emerged from the soil in rearing-cages in which 1911 pupæ were placed during the spring of 1912. To corroborate this important point, I examined four of this year's rearing-cages after the adults had ceased emerging, and in the first I recovered twelve per cent. of the pupæ placed there in the spring; in the second, ten per cent.; in the third, eighteen per cent., and in the fourth, ten per cent. These pupæ seemed to be perfectly healthy.

Apple Aphids. The question which I had to answer most frequently this summer, while I was in Durham and Northumberland counties, was: "How are aphids controlled?" Apple trees in these two counties were very badly infested with plant lice. Even in well-cared-for orchards it was no uncommon sight to see the work of these creatures in the form of clusters of dwarfed apples.

Four species of Apple Aphids occur in Ontario: The Apple Aphis, *A. pomi*, the Grain Aphis, *Hydaphis* (*Siphocoryne*) *avenæ*, the Rosy Apple Aphid, *Aphis sorbi* and the Woolly Apple Aphid, *Schizoneura lanigera*.

In regard to a remedy for aphids, there is a great need for an insecticide as effective as "Black Leaf 40" but not so costly, and which can be applied with lime sulphur.

Green Peach Aphis (*Myzus persicæ*). During late September and early October the return migrants of this species were remarkably abundant in the Vineland District. On bright days the air seemed to be full of them. However, fortunately for the fruit grower the vast majority of these plant lice were destroyed by predaceous and parasitic insects, by spiders (I observed thousands of alate forms caught in the nets of Orb-weavers) and by a fungus *Entomophthora aphides* (?).

Greenhouse Pests.

Sowbugs. Although sowbugs are not insects, they are closely enough related to the hexapods to be of interest to entomologists, and therefore the following notes will not be out of place in an entomological report.

Sowbugs were exceedingly troublesome during the fall of 1912 and the spring of 1913 in the greenhouses of J. Gammage and Sons, London, Ont. Owing to their depredations the carnations were stunted and backward in growth, and the sweet peas had to be sown again. The seedlings of Asparagus plumosus, Primula obconica, Petunia, Lobelia, Solanum capsicum and of many other plants were badly attacked. Tender cuttings, such as those of begonia and coleus, were also severely injured.

I collected three species of isopods in these infested greenhouses: *Armadillidum vulgare, A. quadrifrons* and *Oniscus asellus.*

Systematic trapping by means of inverted flower pots containing damp hay will very materially reduce the number of sowbugs.

A poisoned bait composed of:

2 parts rye flour or Bibby's Calf Meal.
2 parts sugar.
1 part Paris green.

is also an effective remedy.

The tarring of branches is to be recommended, as coal tar, when fresh, acts as a repellant, and as it also preserves the wood it thus deprives the isopods of their favorite harbour—rotten wood.

Large numbers of sowbugs may be destroyed by pouring hot water into the revices and cracks in wooden partitions and benches; by applying it along the edges of greenhouse beds where numerous "bugs" lie concealed; and by flushing cleared benches and the ground beneath them with it. This method can, of course, be used to greatest advantage where the watering system can be temporarily connected with a boiler or where the steam or hot water pipes can be tapped.

The destruction of all rubbish in and around greenhouses is a very important means of prevention.

Tarnished Plant-bug, (*Lygus pratensis*). This past year the Tarnished Plant-Bug, masquerading under the name of the Aster Bug, has been far the most serious pest in many Ontario florist's establishments. By its depredations on chrysanthemums and asters it has been responsible for the loss of hundreds of dollars. In reference to this, the manager of the Dale Estate, Brampton, writes: "A conservative estimate of our loss on chrysanthemums this last season would be $2,000, and on asters, $500."

Dr. Chittenden, of the United States Bureau of Entomology, recommends spraying with a mixture of Black Leaf 40 and Whale Oil Soap as an effective means of controlling this capsid. The keeping down of weeds and the destruction of all rubbish in and around greenhouses is an important preventive measure.

True Bulb Mite, (*Rhizoglyphus hyacinthi*). While in London, Ont., last February, Mr. Gammage, of J. Gammage & Sons, drew my attention to the unhealthy condition of a large percentage of his Easter lilies. The foliage of the diseased plants was sickly, yellowish-green in color and was usually streaked and spotted with light markings. So badly affected were some of the lilies that Mr. Gammage found it necessary to throw out over a thousand of them.

I examined several of the diseased specimens, and in every case I found small translucent mites with brown appendages working in pockets and passages in the bulb, and in many instances, in the stem. These mites were determined by Dr. Nathan Banks as *Rhizoglyphus hyacinthi* Boisduv. As this species works on many kinds of bulbs and will attack perfectly healthy ones, I am inclined to believe that it was the primary cause of the unhealthy condition of the lilies.

Cattleya Fly, (*Isosoma orchidearum*). Early in the year this small hymenopterous fly was reported as being very troublesome in Thomas Manton's orchid house at Eglinton. The female, according to Mr. George Manton, oviposits in the young shoots of the Cattleya plants and the larvæ feed on the orchid substance.

Garden Insects.

Corn Root Aphis, (*Aphis maidi-radicis*). Last summer cultivated asters in a Bowmanville garden were very seriously injured by root aphids belonging to the species *Aphis maidi-radicis.*

Beet Leaf Miner, (*Pegomyia vicina*). The work of this maggot on the leaves of beets was very conspicuous during the summer and fall in many Bowmanville gardens. The fly oviposits on the under surface of the leaf: the larva burrows into the tissues and mines just beneath the upper epidermis. When mature, it drops to the ground and transforms in the soil. From casual observations which I made on this fly I am inclined to think that it has several generations each year in Ontario.

Lecanium corni. During July I came across a number of thimble berry bushes very badly infested with this scale. This *Lecanium* is usually so heavily parasitized that it is seldom serious. Lime sulphur wash, applied after the leaves have dropped and again before the buds have opened in the spring, is an effective remedial measure.

Miscellaneous.

Elm Schizoneurans. Some elm trees in Durham county were badly infested last spring with the leaf-curling species *Schizoneura lanigera* (*americana*).

It will be of interest to note here that during the month of October I secured, on the bark of *Ulmus campestris,* fall migrants of the other elm leaf aphid *S. ulmi* (*foediens*) to which Miss Patch refers in: "A Note on Two Elm Leaf Aphids"—*Journal of Economic Entomology,* Volume 6, Number 3, 1913.

Mediterranean Flour Moth, (*Ephestia kuehniella*). This insect is still imposing a heavy tax on the milling industry and feed trade in Ontario, and it seems to me that the toll is becoming heavier each year. It was particularly troublesome this autumn in a large feed store in Dundas. When I visited this store, I found all the meal and flour literally alive with caterpillars. The moth had been brought into the building in a shipment of corn meal.

Undoubtedly where superheating is practicable it is the most effective method of ridding the mill or store of this scourge. A temperature above 120 degrees Fahrenheit, maintained for at least ten hours will prove fatal to all the adults, caterpillars and eggs of *Ephestia.*

In using the superheating remedy the following precautions are important:

1. No bags of infested meal or flour should be left on the basement floor, as difficulty is often experienced in raising the temperature of this floor to a fatal point.

2. Bags of meal or flour should not be superheated when in piles, but each bag should stand separate so that the heated air can circulate freely around it.

3. Belting and anything else liable to be injured by excessive heat should be removed from the building.

4. Thermometers registering over 120 degrees Fahrenheit or 50 degrees Centigrade should be placed in different parts of the building to insure thorough work.

5. When it is found impossible to maintain a fatal temperature on the basement floor, the same should be scalded with hot water to destroy any caterpillars which might have dropped there.

REPORT OF THE COUNCIL.

The Council of the Entomological Society begs to present its report for the year 1912-13.

The 49th annual meeting of the Society was held at Ottawa on Tuesday and Wednesday, November 19th and 20th, 1912. The day meetings were held at the Carnegie library and the chair was occupied by the President, Dr. E. M. Walker. In the evening a meeting was held at the Normal School and presided over by the Honorable Martin Burrell, Minister of Agriculture for the Dominion. There were a number of members present from a distance and a good attendance of those resident in Ottawa. During the first morning a meeting of the Council took place at the Experimental Farm. A committee was then appointed to consider certain changes in the constitution of the Society which were proposed at a recent meeting at Guelph. Arrangements were also made for marking the Society's 50th Annual Meeting by holding the Jubilee celebration at Guelph and inviting delegates from other societies and institutions. A special committee was appointed to take charge of the arrangements in connection with the meeting. In the afternoon the reports of the Directors on the insects of the year, and of the Montreal, Toronto and British Columbia Branches were read and discussed. The President, Dr. Walker, delivered the annual address, on the "Faunal Zones of Canada." Dr. Hewitt gave a review of Canadian entomology for 1912, in which he described the work of the Division for the year and of the valuable results that had already followed the establishment of field stations. Prof. Lochhead gave an address on the teaching of Entomology in the Agricultural Colleges. Dr. Fyles read one of his charming papers on the "Rise in Public Estimation of the Science of Entomology."

A public meeting was held in the evening in the auditorium of the Normal School. After an introductory address by the Chairman, the Honorable Martin Burrell, Mr. F. W. L. Sladen, of the Division of Entomology, gave a very interesting and instructive lecture on "Bumble Bees and their Ways," illustrated by a number of beautiful lantern slides.

On Wednesday the following papers were read: "The Chinch Bug in Ontario," by Mr. H. F. Hudson; "The Importation and Establishment of Predaceous Enemies of the Brown-tail Moth in New Brunswick," by Mr. J. D. Tothill; "The Discovery of the San José Scale in Nova Scotia," by Mr. G. E. Sanders; "Observations on the Effect of Climatic Conditions on the Brown-tail Moth in Canada," by Messrs. Tothill and Sanders; "Observations on the Apple Maggot in Ontario in 1912," by Mr. W. A. Ross; "Notes on Injurious Orchard Insects in Quebec in 1912," by Mr. C. E. Petch; "Insects of the Season in Ontario," by Mr. L. Cæsar; "Injurious Insects in Quebec for the year 1912," by Prof. W. Lochhead; "Forest Insects in Canada in 1912," by Mr. J. M. Swaine; "The Elater Beetles," by Mr. G. Beaulieu; "Aquatic Insects," by Dr. R. Matheson; "The Entomological Record for 1912," and "Flea Beetles and their Control," by Mr. A. Gibson; "Insect Pests of Southern Manitoba during 1912," by Mr. Norman Criddle; "Some New and Unrecorded Ontario Fruit Pests" and "Arsenite of Zinc as a Substitute for Arsenate of Lead," by Mr. L. Cæsar. A special feature of the meeting was an interesting address by Mr. J. H. Grisdale, Director of the Dominion Experimental Farms, in which a keen appreciation was shown of the work that is now being done in Canada in Economic Entomology.

The Canadian Entomologist, the monthly journal of the Society has been issued regularly each month. The forty-fourth volume was completed in December last. It consisted of 378 pages and was illustrated by a number of full page plates and many original drawings. The contributors numbered 53 and included writers in Ontario, Quebec, New Brunswick, Manitoba, Alberta, Australia, Peru and many states of the Union.

Meetings of the Society were held on alternate Thursday afternoons during winter months in the Biological classroom of the Ontario Agricultural College, and much interest was shown by students of the four years. The average attendance at the meetings was fourteen. The following subjects were taken up and discussed: "The Insects of the Season in Ontario," by Mr. L. Cæsar; "Some Notes on the House Fly," by G. J. Spencer; "The Apple Maggot," by C. A. Good; "Strepsiptera" by A. W. Baker; "The Anatomy of the Honey Bee," by J. C. Millen; "The Role of Insects in the Spread of Fire Blight" by D. Jones; "The Thrips of Ontario," by J. W. Noble; "Entomological Work in Kansas," by Mr. R. Fraser.

The reports of the Branches of the Society at Montreal and Toronto showed that meetings had been regularly held and much active work had been performed. The Council are gratified at being able to report the great increase in the number of members of the British Columbia branch due to the active work carried on by Mr. R. C. Treherne. The Council has much pleasure also in reporting that the total number of new members joining the Society during the past year has amounted to one hundred. The Council wishes to express its gratification at the number who have now assembled in celebration of the Jubilee meeting of the Society which will make this gathering a memorable occasion. It extends a hearty welcome to all our visitors from a distance and trusts that they will enjoy their visit to Guelph.

REPORT OF THE MONTREAL BRANCH.

The fortieth annual meeting of the Montreal Branch was held at 74 McTavish St., on Saturday evening, May 17th.

Members present: Messrs. G. A. Southie, G. Chagnon, H. H. Lyman, A. F. Winn, E. C. Barwick, G. H. Clayson, Geo. A. Moore.

The minutes of the April meeting and of the last annual meeting were read and confirmed. Mr. G. M. Henderson was elected a member of the Branch.

The Secretary read the following:

Report of the Council.

Eight meetings have been held during the season of 1912-13, the average attendance being over six. Two members have been added.

The following papers were read (most of which were illustrated by specimens) and each was thoroughly discussed.

Annual Address of President, G. A. Southee; "The Newman Relaxing Jar," A. F. Winn; "Hibernation of Some Butterflies," A. F. Winn; "Collecting Erebia Cassiope in the English Lake District," L. Gibb; "Collecting at Newago, Que.," G. A. Southee; "Notes on Hepialus Mustelinus," G. A. Southee; "Gelastocoridae or Toad-shaped Bugs," Geo. A. Moore; "Notes on the Eastern Species of Gonodontes," A. F. Winn; "The Second International Congress of Entomology," H. H. Lyman; "Gynandromorphous Butterflies," L. Gibb; "Melanolophia Canadaria and its Allies," A. F. Winn; "The Distribution of Heteroptera," Geo. A. Moore.

The exceptionally rainy season made 1912 a most disappointing year for entomological outings, and this doubtless in part accounts for the falling off in the number of papers read, and the apparent lack of interest. It might be advantageous if the incoming Council, instead of waiting until the fall to plan a programme, could arrange during this month a list of at least one subject for a paper for each monthly meeting, and also appoint a committee of two or three to try and arrange some outings for holidays, or Saturday afternoons. A record of any notable captures made on such trips should be kept.

At the annual meeting of the parent society, the branch was represented by Mr. H. H. Lyman and Mr. A. F. Winn.

The first part of the list of insects of the Province of Quebec, comprising the Lepidoptera, has been published and distributed by the Quebec Society for the Protection of Plants. This was compiled and edited by Mr. A. F. Winn. It is hoped that the members of the Branch will endeavor to get the parts dealing with the other orders ready as soon as possible.

The Treasurer's report shows a balance of $77.86 on hand.

A copy of Dr. Walker's monograph of the Genus Aeshna has been presented to our Society for our library.

Respectfully submitted on behalf of the Council.

(Signed) A. F. Winn, Secretary.

The retiring President, Mr. G. A. Southee, read his annual address, after which the election of officers for the ensuing year was proceeded with and which resulted as follows:

President..... A. F. Winn.
Vice-President..... G. Chagnon.
Secretary.....Geo. A. Moore.
Treasurer and Curator.....H. H. Lyman.
Council.....G. A. Southee, E. C. Barwick, G. H. Clayson.

Mr. A. F. Winn exhibited a jar of larvæ of *Haploa confusa* found that afternoon at Notre Dame de Grace. Mr. H. H. Lyman exhibited a certificate of an honor recently bestowed upon him, that of being elected Fellow of the American Association for Advancement of Science. He received the congratulations of all present.

The meeting then adjourned.

Geo. A. Moore, Secretary.

REPORT OF THE TORONTO BRANCH.

The seventeenth annual meeting of the Society was held on Tuesday, June 10, 1913, in the Biological Building, the President, Dr. Cosens, in the chair. The members present were Dr. Cosens, Dr. Walker, Messrs. Snazelle, Williams, Auden, Logier, and Smith. After routine business of regular meetings was disposed of the Secretary read the report of the Council.

Ten meetings in all, including a special business one and the final business one, were held during the season 1912-13. An open meeting was held in January. Dr. Walker had arranged in the Biological Museum the collection of Forest Insects and their work, which he has been making for the Forestry Department of the Uni-

versity. It already contains illustrations of the important forest pests. There was a large attendance of visitors, and Dr. Walker gave an interesting lecture descriptive of the collection. The whole museum was open after the meeting for inspection of those present.

The average attendance at the other meetings was eight. A number of exceptionally interesting papers have been given and have been much appreciated by the members. The titles are as follows:

Nov. 14.—Dr. Walker, "The Map of the Faunal Zones of North America." Paul Hahn, Report of the successful campaign against the Tussock Moth in Toronto.

Dec. 12.—Dr. Cosens, "The Entomologist in Fiction."

Jan. 9.—Dr. Walker, "Forest Insects."

Feb. 20.—V. Jackson, "New Zealand Insects."

Mar. 13.—J. B. Williams, "Butterfly Hunting in Many Lands, by Langstaff." Dr. Walker, "Present State of our Knowledge of the Insect Fauna of Toronto District."

April 10.—W. A. Clemens, "May Flies."

May 8.—Dr. Cosens, "Lantern Slides, illustrating the Structure of some Insect Galls."

June 10.—Dr. Walker, "The introduction of Parasites in the Control of the Gypsy and Brown-tailed Moths."

Field meetings were held on May 3rd at York Mills, and on May 24th at Mount Dennis. At York Mills, many galls of *Rhabdophaga strobiloides* were found containing eggs of a *Xiphidium,* probably *ensiferum.* At Mount Dennis a dragonfly, *Ophiogomphus rupinsuiensis* was captured; this is new to the Toronto district.

Five new members have joined the branch during the year, and two members have resigned. The year has been unusually successful financially.

Mr. Williams submitted the report of the Librarian. The Branch subscribes for The Entomological News and for The Annals of the Entomological Society of America. The publications of the Bureau of Entomology at Washington and the Entomological Reports from the New York State Museum at Albany have also been regularly received.

The election of officers resulted as follows:—

President..... Dr. A. Cosens.
Vice-President..... Dr. E. M. Walker.
Secretary-Treasurer....E. H. Craigie, 40 Leopold St.
Librarian..... W. Logier.
Council..... J. B. Williams, V. Jackson, C. W. Nash, Arthur Smith.

Respectfully submitted,

E. H. Craigie,

Secretary.

REPORT OF THE CURATOR.

While the Society's collections have been examined regularly throughout the past year and kept in order, with the exception of a few Diptera, they have had no additions made to them. Correctly named specimens of Hymenoptera, Diptera, and Hemiptera are badly needed, and gifts of specimens from members who have them to spare would be greatly appreciated. The collections have been frequently used by fourth year students for identification purposes, and by a considerable number of visiting members.

Respectfully submitted,

G. J. Spencer, Curator.

REPORT OF THE LIBRARIAN.

During the year ending October 31st, 1913, 32 bound volumes have been added to the library, making the total number on the register 2,185. There have also been added a large number of periodicals and other publications of scientific societies throughout the world as well as bulletins and pamphlets. These are classified so as to be available for reference. Amongst the additions to the library may be mentioned the following: "Catalogue of Lepidoptera Phalænæ in the British Museum," Vols. 11 and 12 by Sir George Hampson; "The Humble Bee," by F. W. L. Sladen; "Aquatic Insects in New York State," by Professor Needham and others; "Entomology with Reference to its Biological and Other Aspects," 2nd edition, by J. W. Folsom; "Social Life in the Insect World," by J. H. Fabre; "Handbuch der Pflanzenkrankheiten," by Professor Paul Sorauer.

The library continues to be largely used by the Biological students and staff of the Ontario Agricultural College and is of great assistance to them in their scientific investigations. Want of space unfortunately prevents a proper classification being made of the books and they are consequently not arranged in a satisfactory order.

Respectfully submitted,

Charles J. S. Bethune,

Librarian.

REPORT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO TO THE ROYAL SOCIETY OF CANADA.

W. Lochhead, Macdonald College, Que.

As delegate of the Entomological Society of Ontario I have the honour of presenting the following Report:

The work of the Society during the past year has been attended with the usual success. The number of active workers has increased in recent years, due to the demand for investigation into the losses caused by the increased number of insect pests that prey upon the crops of the farm, orchard, garden and forest. The great

expansion of agriculture in Canada and the attendant extension of trade with various parts of the world have brought the study of economic entomology into greater prominence than formerly. New pests threaten us, and old ones demand further investigation. There is a pressing demand for the discovery of more effective methods of control which call for men of considerable practical knowledge of the various branches of agriculture and a thorough grounding in entomology and related subjects. Fortunately our Agricultural Colleges are turning out such men, but the demand is still greater than the supply.

In order to cope with the work in hand, new lines of investigation are being followed. For example, trained men are now located at field stations in infested areas, where they are able to study the pests at work, learn their habits and life history, and work out effective methods of control. Attention is being given also to the breeding of parasitic insects which prey upon injurious forms with the hope of restoring the balance which has been disturbed. Along these lines the Society with its many trained men is doing active work.

The forty-ninth annual meeting of the Society was held in the Carnegie Library, Ottawa, November 19th and 20th last, with a large attendance of members present. An account of the papers read will be found in the forty-third Annual Report of the Society soon to appear.

The titles of the papers are:

"Faunal Zones of Canada," by Dr. E. M. Walker (President's Address).
"Review of Canadian Entomology for 1912," by Dr. Hewitt.
"The Teaching of Entomology in the Agricultural College," by Prof. Lochhead.
"The Rise in Public Estimation of the Science of Entomology," by Rev. Dr. Fyles.
"Bumble-Bees and Their Ways," by F. W. L. Sladen (Public Lecture).
"The Chinch-Bug in Ontario," by H. F. Hudson.
"The Importation and Establishment of Predaceous Enemies of the Brown-tail Moth in New Brunswick," by J. D. Tothill.
"The Discovery of the San José Scale in Nova Scotia," by G. E. Sanders.
"Observations on the Effect of Climatic Conditions on the Brown-tail Moth in Canada," by Messrs. Tothill and Sanders.
"Observations on the Apple Maggot in Ontario in 1912," by W. A. Ross.
"Notes on Injurious Orchard Insects in Quebec in 1912," by C. E. Petch.
"Insects of the Season in Ontario," by L. Caesar.
"Injurious Insects in Quebec in 1912," by Prof. Lochhead.
"Forest Insects in Canada in 1912," by J. M. Swaine.
"The Elater Beetles," by G. Beaulieu.
'Aquatic Insects," by Dr. R. Matheson.
"The Entomological Record for 1912," by A. Gibson.
"Flea Beetles and Their Control," by A. Gibson.
"Insect Pests of Southern Manitoba During 1912," by N. Criddle.
"Some New and Unrecorded Ontario Fruit Pests," by L. Caesar.
"Arsenite of Zinc as a Substitute for Arsenate of Lead," by L. Caesar.

The Canadian Entomologist, the publication of the Society, under the editorship of Dr. E. M. Walker, has now entered its forty-fifth volume, and is recognized as one of the most valuable Entomological Magazines on the continent.

The Society is now entering upon its fiftieth year of existence, and will hold its Jubilee at Guelph at the end of August. Invitations have been issued to the Scientific Societies of America to send delegates to the meeting. It is noteworthy that one of the founders of the Society, Rev. Dr. Bethune, is President for the present year, and will preside over the meetings at the Jubilee Celebration.

GREETINGS FROM SURVIVING ORIGINAL MEMBERS.

Wm. Saunders, LL.D., the first Secretary-Treasurer of the Entomological Society of Ontario, and for a number of years its President, sent cordial greetings to the officers and members by his son, on the occasion of the jubilee of the Society. Dr. Saunders' health was too frail to permit him to attend the gathering.

Mr. Edmund Baynes Reed, another surviving charter member, also sent a message from his present home in Victoria, B.C. Among other things he said:

"I have a vivid recollection of the organization of our society and our first meeting at the residence of Professor Croft, and I have many pleasant memories of long years of friendly intercourse with many of my brethren of the Net. It seems hard to realize that only three of us remain of our original Charter number, but amidst all our feelings of sincere regret for the many absent friends and members who have "crossed the bar" there are bright and cheering thoughts of the splendid work carried on with their assistance so perseveringly for many years, which has helped to place our Society so deservedly in the forefront of this our chosen branch of Natural History. I especially bear in mind our valuable Library, in which I have always taken the deepest interest from its earliest days, when it began with some half dozen books lent by myself."

Mr. N. H. Cowdry, who was one of the earliest members of the Society, writing from Chicago, Ill., said: "It is hard for me to realize that fifty years have passed since the first meeting. I was then fourteen years old, and can well remember some meetings which were held in a room opposite what is now the Assistant Receiver General's office in Toronto, and also some at the residences of Professors Croft and Hincks and Dr. Sangster. Some field days also interested me very much."

THE ROYAL SOCIETY OF CANADA.

The Royal Society of Canada takes a particular pleasure in extending to the President, officers and members of the Entomological Society of Ontario its felicitations on the occasion of your fiftieth annual meeting. As one of its affiliated societies, the Royal Society is mindful of the progress and invaluable work of your society whose field of labor is co-extensive with its own. The inclusion in its fellowship, however, of so many Canadian entomologists who have gained distinction through their advancement of the science, strengthens the bond which exists between the two societies. We would remind you that one of your founders, Dr. Wm. Saunders, C.M.G., is not only a charter member of the Royal Society also, but held with distinction the office of President of the Royal Society in 1906-7. Your Jubilee President, the Rev. Charles J. S. Bethune, M.A., D.C.L., and another of the founders of your society, has for many years been a Fellow of the Royal Society of Canada. The late Dr. James Fletcher, LL.D., twice your President, filled the office of Honorary Secretary of the Royal Society and worked for its welfare with that characteristic devotion which is known so well to your Society and which advanced your science in Canada to a degree not previously attained. As a Fellow of our Society we also deplored the death of the Rev. G. W. Taylor, whose studies in the Geometridæ gained him a continental reputation, and another of our Fellows, Mr. W. H. Harrington, added consider-

ably to our knowledge of the Hymenoptera. In view of the enormous advances which have been made in Entomology during the last few years, especially in so far as the study of insects is related to the progress of agriculture and the prevention of human and other diseases the Royal Society feels assured that your work cannot be otherwise than of inestimable value to the people of Canada and to the advancement of knowledge. As a joint labourer in a field of unequalled opportunities, it desires to express to you its sincere wish for the continuance in even greater measure of that success which has so conspicuously attended your efforts in the past and for the progress of your science which has so intimate a bearing on the prosperity of this country.

FRANK D. ADAMS, D.Sc., F.R.S., *President.*

DUNCAN C. SCOTT, F.R.C.S., *Honorary Secretary.*

ADDRESSES BY DELEGATES.

Brief addresses, referring to the Jubilee of the Society, were given by a number of persons representing certain bodies or institutions, as follows:

REV. PROF. C. J. S. BETHUNE: I have been appointed by its President, Dr. Philip P. Calvert, to represent the American Entomological Society on this occasion, having been elected a corresponding member as far back as October 16, 1862. I have also the honour to be President this year of the Entomological Society of America, a much younger organization, which will be represented by its Secretary, Prof. MacGillivray, of Urbana, Ill.

The American Entomological Society of Philadelphia is one that claims precedence over our Ontario Society, having been organized in the year 1859, four years before ours came into existence. It began, as we did and many other institutions that have grown and prospered, in a very humble way. Three men, who were students of insects, met at the house of Mr. Ezra T. Cresson, one of the three in Philadelphia, on the 14th of February, 1859, and decided to form a Society for the advancement of Entomological Science. After talking the matter over, they arranged to invite all their acquaintances who were interested in the study, to attend a meeting during the following week and at the same house. On February 22, 1859, fifteen persons were present at the meeting and the organization was formed and named "The Entomological Society of Philadelphia." For some time their numbers were small, their finances very meagre and their meetings were held in private houses, but they were full of energy and enthusiasm. Soon the want of some means of publishing the papers and observations of members was felt, and a subscription was taken up to purchase a printing press and type. A small outfit was secured at a cost of $74.50, and the members after business hours worked hard and late in setting up type and striking off copies with the small hand press, which would only serve for one page at a time. Thus was begun the publication of the "Proceedings of the Entomological Society of Philadelphia" in March, 1861. A larger press and printing equipment were soon found to be necessary, but until January, 1885, the work continued to be done by volunteer amateurs. It is remarkable how well they did their work and how few are the errors to be

found in those pages. Six volumes of these "Proceedings" were published, but are now out of print and a complete set will find a ready purchaser at a price of $50, so valuable is the work considered.

By 1867 the membership of the Society and the scope of its work had extended over the continent; it was therefore decided to change its name to "The American Entomological Society" and to issue its publications under the title of "Transactions" instead of "Proceedings." Thirty-nine volumes of the new series have now been published, appearing in quarterly numbers. They are a perfect mine of information on insects of all orders and are of so high a scientific character that no systematic worker can get on without them.

On behalf of this great and flourishing Society and by request of its President I have great pleasure in tendering to the Entomological Society of Ontario its hearty congratulations on the celebration of its Jubilee, and its best wishes for the continued success and prosperity of its Canadian co-worker in the vast field of Entomology.

Prof. E. M. Walker: I have the honour of extending to you the greetings and congratulations of the University of Toronto on the occasion of the fiftieth anniversary of the Society's foundation.

Although Entomology has never been a prominent subject on the University curriculum this deficiency must not be taken as indicative of an underestimation of its value as a study or its importance to the community, for the Biological Department is highly appreciative of the importance and usefulness of the work that is being done by the Entomological Society of Ontario. The small place given to Entomology on the curriculum is due partly to the fact that as yet there is no faculty of agriculture in the University and partly because the elective system of instruction is not followed in our University, and it is, therefore, very difficult to provide for the teaching of special branches of zoology, such as entomology. The curriculum in biology is already almost overloaded with the more fundamental subjects.

The need of some knowledge of systematic zoology, particularly in entomology, is, however, keenly felt by many of our graduates who become science teachers in the high schools and collegiate institutes, and we are now offering a course in this subject which, it is hoped, will meet this need to some extent. It is hoped also that more of our graduates in biology may thus be stimulated to take a closer interest in entomology and the Entomological Society of Ontario.

The University of Toronto extends it best wishes for the continued growth and prosperity of the Entomological Society of Ontario.

Prof. W. Lochhead offered the felicitations of McGill University, Montreal, and referred to the strong men who had been leaders in the work of the Society.

Dr. C. Gordon Hewitt: I have been requested by the Minister of Agriculture, the Hon. Martin Burrell to represent the Department of Agriculture and to convey to the Society his hearty congratulations on this occasion. As many of you know, he takes a personal interest in entomology, especially in its economic aspects. In referring to the entomological work in the Canadian Department of Agriculture, I should like to say under what a great obligation we are to Dr. Bethune for the supply of men he has been able to give us. If it were not for the Ontario Agricultural College and the splendid training which is given to stu-

dents who specialize in Entomology we could not have made such progress as we have been able to make. Their work speaks well for the excellent training they have received from Dr. Bethune.

Mr. J. C. Chapais, representing the Quebec Society for the Protection of Plants, after offering congratulations, spoke of the splendid work done for entomology in the Province by the late Abbé Provancher, and by Rev. Thos. Fyles.

Mr. R. C. Treherne conveyed the compliments and the good wishes of the British Columbia Entomological Society and more especially to the honored President, Dr. C. J. S. Bethune, from whom they had always received sound advice and encouragement.

Mr. H. H. Lyman, in the absence of Mr. A. F. Winn, presented the felicitations of the Montreal Branch of the Entomological Society of Ontario. He referred to the celebration, fifteen years ago, of the 25th Anniversary of the Branch, which has the honour of being the third senior entomological society on this continent, being antedated only by the American Entomological Society and the parent society. He extended warm congratulations to the revered president, Dr. Bethune, and expressed the hope that he might long be spared to the society.

Dr. A. Cosens very cordially extended the greeting of the Toronto branch of the Entomological Society of Ontario.

Mr. Arthur Gibson, representing the Ottawa Field-Naturalists' Club, offered warm congratulations. The Club desired to place on record its full appreciation of the splendid results achieved by the Entomological Society of Ontario during the fifty years of its existence. The series of volumes of the Canadian Entomologist and the yearly reports of the Society are invaluable to students of insects of every country.

Prof. Comstock extended the heartiest congratulations of the Entomological Society of London.

Prof. P. J. Parrott said: In representing the American Association of Economic Entomologists it gives me great pleasure to present greetings to the Entomological Society of Ontario at this celebration of its fiftieth anniversary and to express our heartiest congratulations upon the completion of this period of honorable and effective service, and to extend warm wishes for continued success and prosperity.

F. M. Webster, representative of the Entomological Society of Washington and the Bureau of Entomology, U.S. Department of Agriculture, brought greetings from these. He spoke with feeling of the high character and ability of the late Dr. James Fletcher, and referred to the excellent work done by Dr. Saunders and Dr. Bethune. He also said that they had a number of graduates from Guelph in the Bureau, and "if we have a poor one, I certainly do not know it."

Prof. J. H. Comstock, representing Cornell University, said: Your colleagues in the study of Entomology at Cornell University wish to extend to you our heartiest congratulations on your completion of fifty years of most eminent service to our favorite science.

The unselfish devotion of the members of this society to science has been an inspiration to all American entomologists. The appearance of your journal, *The Canadian Entomologist,* has been eagerly looked for monthly by many readers across the border. In fact this journal has been Canadian only in name, for the generous treatment of contributors living south of the Great Lakes has made us feel that it is our journal also, and those of us who have been admitted to membership in the Entomological Society of Ontario appreciate the honour most deeply.

Dr. E. P. Felt, representing the New York Entomological Society, briefly said: The New York Entomological Society, through its accredited representatives, hereby conveys to the Entomological Society of Ontario its most hearty felicitations upon this Jubilee occasion. We would also extend to your highly respected and beloved President a most sincere appreciation of the part he has taken in establishing the Society and putting entomological work in Canada upon such a satisfactory basis.

Mr. Geoffrey Meade-Waldo, representing the British Museum Natural History Department, brought most hearty congratulations from the President of the British Museum to the Entomological Society of Ontario on the accomplishment of fifty years of such splendid work, with all best wishes for future prosperity.

Dr. R. Stewart MacDougall, representing the University of Edinburgh, Scotland, and the Imperial Bureau of Entomology, was hearty and sympathetic in his congratulations. He also remarked that the Entomological Society of Ontario was celebrating its jubilee at a time when more than ever before an interest was being taken in economic entomology.

Dr. C. Gordon Hewitt represented the University of Manchester, England, and on behalf of that institution presented greetings and sincere wishes for continued success. He also extended congratulations as representing the Academy of Science, of Philadelphia.

Mr. J. D. Totihill conveyed the hearty congratulations of the Natural History Society of New Brunswick which, only a few months ago, had celebrated its own 50th anniversary. As a proof of the Society's interest in entomology he mentioned that it had embarked upon the preparation of a list of New Brunswick insects, somewhat after the plan of the late Dr. J. B. Smith's "Insects of New Jersey."

LETTERS OF CONGRATULATION.

Letters from a number of representative bodies, all of them encouraging and most of them couched in most felicitous terms, were received, and read. Unfortunately there is room in this report only for their bare acknowledgment, as follows:

Laval University, Quebec.
University of Cambridge.
University of Oxford.
Natural History Society of Glasgow.
Boston Society of Natural History.
California State Commission of Horticulture.
University of Chicago.
University of Colorado.
The Essex Institute, Salem, Mass.
Harvard University.
University of Iowa.
Kansas State Agricultural College.
Leland Stanford Junior University.
German Entomological Museum.
Imperial Academy of Sciences, St. Petersburg, Russia.

Letters of a congratulatory nature were also received from a number of individual well wishers.

PRESIDENTIAL ADDRESS.

Rev. Prof. C. J. S. Bethune, O.A.C., Guelph.

For nearly a year now I have been unable to write, and for a longer period unable to read without considerable difficulty; you can, therefore, understand that it has been quite impossible for me to prepare a formal address to present on this occasion. It has been suggested to me that it might interest those who are here to-day to tell you something about the formation of the Society, and also of the conditions under which we, who were young at that time, had to work, so different from those of the present day.

To tell you about these things involves speaking about myself, and I may be considered somewhat egotistical, but that is natural if one speaks of one's self. When I was a student at Trinity College, Toronto, a good while ago, I became very much interested in entomology. There were classes at the college in Elementary Physics, called then "Experimental Philosophy," in Chemistry and Geology, but there were no lectures in Biology. At that time meetings of the Canadian Institute were held on Saturday evenings through the winter months. I was enabled to join as a junior member and used to attend these meetings, which concluded with coffee and biscuits in a sociable way, and thus the members got to know each other. Though only a young man, I formed acquaintance with the professors at the Toronto University, with which Trinity College had nothing to do in those days. Dr. Croft, professor of Chemistry, and Prof. Hincks of Botany, were two with whom I became most intimate.

I was given access to the University Library, and found a good many old works on entomology. One day Prof. Croft said, "You ought to know young Saunders of London; he is a chemist but is much devoted to entomology, you should make his acquaintance." So I wrote to "young" Saunders, and that was the beginning of a friendship which has now lasted for over half a century. We began writing frequently, and subsequently visited each other, which led on to the formation of this Society. At that time he was a very slight and delicate young man, one would hardly think he could live for any length of time, and one could not imagine then that he would develop into the broad shouldered man he afterwards became. I think his improvement in strength was largely due to doing entomological work and spending all the time he possibly could out of doors. In those days he was a druggist and chemist, kept a drug store in London, and lived in rooms above, having a laboratory in the rear. Dr. Saunders was one of the most remarkable men I ever met through his capability for doing good work in so many different directions. He was an excellent botanist, and one of our foremost men in economic entomology. He was greatly interested in growing fruit, and knew all about the different varieties, having a fruit-farm on the outskirts of the city and being at times President of the Ontario Fruit-Growers' Association. He was also well known amongst pharmaceutical people, and was President of the American Society of that name. He was a member of the American Association for the Advancement of Science; one of the original Fellows of the Royal Society of Canada; Director of the Huron and Erie Savings Society, and interested in other business organizations. On Sundays he had a class of about seventy young children whom he used to instruct in a delightful manner. Finally, possessing all these accomplishments and attainments, he was chosen as Director of the Experimental Farms of the

Dominion, and moved to Ottawa, and his work since has been widely known. He had to plan out the whole organization of the system and it has been wonderfully successful.

Now to get back to my early days. When I began collecting and studying insects there were no publications available. The first book that gave me any idea of Canadian insects was Gosse's "Canadian Naturalist." (Dr. Fyles mentioned this in his paper last year). It was in the form of conversations carried on between father and son describing all the natural phenomena that were to be observed during each month of the year. There were illustrations given of a few butterflies and beetles and the names of some of them, but the list was very meagre.

There was a printer in Toronto by the name of Couper, a man of no education to speak of, but who was devoted to entomology and nature in general. He published a series of papers in the *Canadian Journal*, giving brief descriptions of all the larger beetles to be found in the neighborhood of Toronto. This was an immense help to me and others who were interested in these insects. He also published a calendar, giving dates of appearance of birds and insects. In those days before Confederation, Canada consisted of the provinces known as Upper and Lower, now called Ontario and Quebec, and Parliament met in Toronto. It had a wonderful library for those early days, in which I was permitted to go and read, but not to take any books out; so I spent there any time I could, and copied out descriptions of insects and made drawings of illustrations. The descriptions were mostly in Latin or French. The Library had the early issues of the Journals of the Academy of Natural Sciences of Philadelphia and other Societies. It was thus no simple or easy matter to get any literature whatever on the subject of entomology. The greatest help I obtained was a copy of Westwood's Modern Classification of Insects, which at the time I procured it was an expensive book. From Kirby and Spence's Entomology I also learnt a great deal, though the third and fourth volumes which were more technical, I could not get access to until sometime later.

This, I hope, will give our younger members encouragement in carrying out this study. If we had had such works as Comstock's Manual and Mrs. Comstock's "How to Know the Butterflies," they would have been treasures indeed.

My acquaintance with Dr. Saunders led to our talking over matters from time to time, and we resolved to try and get entomologists in Canada acquainted with each other. By the aid of correspondence we got together the names of thirty-six people in Canada who took some interest in entomology. The list was published with addresses in the "Canadian Naturalist and Geologist," Volume VII, pages 199-201, Montreal, June, 1862. We thought the time had arrived to hold a meeting. We issued invitations to meet in Toronto at the residence of Prof. Croft, the autumn of 1862, but only ten were able to come. We discussed the question of forming a Society, but the matter was postponed until the following spring, because it was thought that the members present were too few to be considered representative. We then called another meeting which was held on the 16th of April, 1863, in the rooms of the Canadian Institute in Toronto. There were only twelve present, but we had letters from several others and so we decided to go on. A constitution was adopted and the society was named The Entomological Society of Canada. The members at that meeting were: Prof. Croft, D.C.L., who was elected President; the Rev. Prof. W. Hincks, F.L.S., who acted as Chairman; Dr. Sangster, Principal of the Normal School in Toronto and publisher of various school books that were in use throughout this Province, one in use for many years was called Sangster's Arithmetic. Mr. J. Hubbert, a Divinity student at Knox's College,

Toronto, and who was our first Curator; Dr. Cowdry, an Englishman, who had come to Canada some years before, was present, and his son, Mr. N. H. Cowdry, whose letter has been read to-day, was with him. Dr. Saunders, of course, was there and was elected Secretary-Treasurer; Dr. Beverley R. Morris, who left Canada soon afterwards and returned to England where he became editor of a popular journal on natural history. Mr. E. Baynes Reed of London was unable to come to the meeting, but was at the previous one, and thus was one of the original members. This means that there are four of the original members still alive: Dr. Saunders, Mr. Baynes Reed, Mr. Cowdry, and myself. It is certainly somewhat remarkable that out of that small gathering there should be four still alive after a lapse of fifty years. I may mention that the week after this meeting I was married and went to England, and was absent from this country for a year and a half. During my visit to England I came to know Dr. Francis Walker of the British Museum, who was extremely kind to me, and other entomologists whose names are still well known.

On my return from England Dr. Saunders was elected President, and I was made Secretary-Treasurer of the Society, and held that office for some years. So matters went on until the year 1868. I was then living at Erindale, about 20 miles west of Toronto, and had charge of a country parish covering seventy square miles. My spare time I devoted to entomology. After much consultation I began the publication of *The Canadian Entomologist* magazine, which was to be the organ of the Society. The first number consisted of eight pages, and the prospectus stated that the periodical would be issued "not oftener than once a month," and only when sufficient material was supplied. The material has never failed, and it has been issued month by month for forty-five years.

We were very much encouraged in our venture by letters from friends in the United States. I remember particularly Mr. Samuel H. Scudder, of Cambridge, Mass., the author of a wonderful book on "Butterflies of the Eastern States and Canada" and other works, Hagen, Drs. Packard and Riley, and others of the old days. So we went on and the magazine grew in size and favour and gradually came to have a good circulation, and now there are subscribers in almost every civilized country in the world. The volumes have become of such importance to students that we are frequently asked for a complete series of the back volumes, and every now and then we send whole sets to different parts of the world. Sets have been sent to St. Petersburg, to Germany and California, and constant applications are received for single numbers. Anyone who makes a specialty in any department of entomology finds that he must consult some part or other of *The Canadian Entomologist.*

In the year 1870 we were asked to prepare a report on injurious insects. Dr. Saunders, Mr. Reed, and myself put our heads together, and we determined we would do our best to fulfil this requirement. The result was that the following year there was issued the first Annual Report of the Entomological Society of Ontario. There were three articles in all; mine was on insects affecting apple trees; Dr. Saunders wrote upon insects affecting the vine, and Mr. Reed on those attacking the plum. We tried to make these articles as exhaustive as possible, describing all the insects we knew that attacked these important fruits. The report was received with great favour, and was widely distributed by the Department of Agriculture. It was the beginning of a series that has now gone on for forty years. That first volume was considered so satisfactory that it was reprinted twenty-five years later.

The effect of the publication of our first report was that the Department gave the Society an annual grant. The first was $400, but happily for us the Society's fortunes were made by the advent of the Colorado Potato Beetle. We had been noticing how this insect pest was working its way from the far west to the east. I had seen it on the shore of Lake Michigan at Chicago, and it had now reached Detroit, and was preparing to cross the St. Clair River to Ontario. The danger was brought to the notice of the public through the agricultural and other papers, and we were asked to investigate and draw up a report. Dr. Saunders and Mr. Reed took the matter up, but by that time the beetle had established itself on our frontier. They tried various experiments. Dr. Saunders, being a practical chemist, understood the use of arsenicals, and found Paris green to be a very effective killing agent. The report they made was a very good one, and it was published in one of our annual reports as well as separately. The result was that our annual grant was increased to $1,000, and has been continued ever since. This much we owe to the Colorado Potato Beetle!

For nine years the Canadian Institute in Toronto gave the Society the privilege of using its library and museum for its meetings and collections. Meanwhile a flourishing branch of the Society grew and developed in London, and in 1872 it was decided to remove the headquarters to that city and rent rooms for the accommodation of its books and collections. There it remained for no less than thirty-four years, and in 1906 a removal was made to the Ontario Agricultural College, Guelph.

The history of the Society since those early days may be found recorded in our chronicles—*The Canadian Entomologist* and the Annual Reports.

Now I am reminded that I must bring these reminiscences to a close. Before doing so I wish to express the great pleasure it has given my colleagues and myself that so many friends have come from long distances to join in the celebration of the Jubilee meeting of the Society. We give you all a most hearty welcome and hope that you will fully enjoy your visit.

LIST OF ENTOMOLOGISTS IN CANADA IN THE YEAR 1862.

From The Canadian Naturalist and Geologist, Volume 7—pp. 199-201, Prepared by C. J. S. Bethune and Wm. Saunders.

Beadle, D. W., St. Catharines, C. W., Coleoptera and Lepidoptera.

Bell, R., Provincial Geological Survey, Montreal. All orders, but specially Coleoptera and Lepidoptera.

Bethune, Rev. Charles, J. S., B.A., Cobourg, C. W., Coleoptera and Lepidoptera.

Billings, B., Prescott, C. W., Coleoptera, Lepidoptera and Orthoptera.

Billings, E., F.G.S., Provincial Geological Survey, Montreal. Coleoptera and Lepidoptera.

Bush, Geo., Coldwater, County of Simcoe, C. W., Insects of all orders; collects also for sale.

Clementi, Rev. Vincent, B.A., Peterboro', C. W., Coleoptera and Lepidoptera.

Cottle, Thomas, Woodstock, C. W., Lepidoptera.

Couper, William, National Bank Building, John Street, Quebec. "Entered the entomological fields of Canada in 1843, and still continues his researches. Collects all the orders, and studies the geographical distribution of Coleoptera."

Cowdry, Thomas, M.D., York Mills, County of York, C. W., all orders.

Cowdry, N. Harrington, York Mills, C. W.

Croft, Prof. Henry, D.C.L., University College, Toronto. Collects all orders, but more especially Hymenoptera and Coleoptera. His collection of Coleoptera is the finest in the Province.

Crooks, Miss Kate, Hamilton, C. W.

Cummings, Willoughby, Chippawa, C. W., Coleoptera and Lepidoptera.

Denton, J. M., Dundas Street, London, C. W., Lepidoptera and Coleoptera.

Devine, Thomas, Crown Lands Department, Quebec.

Dewar, Miss, London, C. W., Coleoptera and Lepidoptera.

Edwards, W., Port Stanley, C. W., Coleoptera and Lepidoptera.

Gibbon, Miss, St. Mary's, C. W., Lepidoptera.

Girdwood, G. P., Asst. Surgeon, Grenadier Guards, Montreal.

Girdwood, Mrs. G. P., Montreal.

Grant, Francis, Orillia, C. W., Coleoptera and Lepidoptera.

Hill, Rev. Geo. S. J., M.A., Markham, County of York, C. W., Coleoptera and Diptera.

Hincks, Rev. William, F.L.S., Prof. of Nat. Hist., University College, Toronto. Studies all orders, but does not collect.

Hubbert, James, Knox College, Toronto, and (during vacations) Grafton, County of Northumberland, C. W., Diptera, Neuroptera, and, to some extent, Coleoptera.

Kreighoff, C., Quebec. Insects of all orders; pays particular attention to Lepidoptera (Heterocera) and Coleoptera.

Lawford, J. M., Toronto, Lepidoptera and Coleoptera.

Lawrason, W. L., Dundas Street, London, C. W., Lepidoptera and Coleoptera.

Morris, Beverley R., M.D. Institution for the Deaf and Dumb, and the Blind, 490 Queen Street, Toronto. All orders, but chiefly Coleoptera and Lepidoptera.

Provancher, Rev. L., St. Joachim, Montmorency, C. E. All orders, except Aptera; pays special attention to Lepidoptera and Coleoptera.

Reed, E. Baynes, London, C. W., Coleoptera and Lepidoptera.

Reynolds, T., Financial Director, Great Western Railway, Hamilton, C. W., Lepidoptera.

Rooke, Capt. W. S., Scots Fusilier Guards, Montreal. Coleoptera and Diurnal Lepidoptera.

Saunders, William, Dundas Street, London, C. W. All orders, chiefly Coleoptera and Lepidoptera.

Turton, F., Simcoe Street, London, C. W. All orders, chiefly Coleoptera and Lepidoptera.

Rogers, Robt. V., Jr., St. James' Parsonage, Kingston, C. W.

AN ENTOMOLOGICAL PICNIC.

Rev. Prof. C. J. S. Bethune, Guelph.

The first Entomological picnic held in Canada took place on the 8th of July, 1868. The annual general meeting of the Entomological Society was held by invitation of the London Branch in their rooms in the City Hall, London, on Tuesday, the 7th of July. The next day "the members met at 8.30 a.m. and drove a few miles into the country for an Entomological field day and picnic. On arrival at the selected place, all betook themselves to the woods, fields and river side and spent a few hours in the capture of insects of various orders. Many rare and inter-

esting specimens were taken and fair success was obtained by all. At midday they reassembled for lunch, which was kindly provided by the London members, and after it had been duly discussed and enjoyed, another sally was made upon the insects in the neighborhood until the time of departure arrived. A photograph of the members of the group was taken by Mr. Griffiths as a memento of this first pleasant gathering of the Society under its new constitution."—(*The Canadian Entomologist,* Volume I., No. 1. Page 8, August, 1868). In the accompanying photograph may be seen sitting upright on the fence, Mr. Wm. Osler, now Sir Wm. Osler, Baronet, Regius Professor of Medicine at the University of Oxford. Reclining on the fence is Mr. Edmund Baynes Reed, one of the original and most active members of the

Entomological Picnic at London, Ont., July 8, 1868.

Society. He is now in charge of the Meteorological Station at Victoria, British Columbia. Reading from left to right, the boy was Mr. Symonds, afterwards a druggist in London; second C. Chapman, bookbinder, London; third, Mr. J. M. Denton, for many years a very active member; 4th, the Rev. C. J. S. Bethune; 5th, Wm. Saunders, and, standing in front of him, his son, W. E. Saunders, now well known as one of the best ornithologists in Ontario; 6th, Dr. Sangster; 7th, his son; 8th, Professor Croft, first President of the Society; 9th, the Rev. R. H. Starr. Sitting on the ground are Mr. J. Watterman and Mr. C. Symonds. Several of those represented were not greatly interested in entomology, and after some few years ceased to be connected with the Society. This is the only photograph of Professor Croft that is possessed by the Society, and is therefore of considerable interest.

GREEN LANES AND BYWAYS.

REV. THOS. W. FYLES, D.C.L., OTTAWA.

OLD COUNTRY LANES.

I

"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 (*Cretægus 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 vigor.

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 Coritani 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 road, 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.

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

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 thy 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.

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

Many beautiful butterflies sport around. I can mention but a few of them. The pretty Speckled Wood (*Lasiommata ægeria*) is everywhere in evidence. The lovely Peacock (*Vanessa io*) and the Brimstone (*Gonepteryx rhamni*) show 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 shows itself, and formerly the Black Veined White (*Aporia cratægi*) 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,

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 merle 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 Stonecrop (*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 (*Amphicarpœa monoica* Nutt.), but there I had seen it in its short flights only, as it skipped from bush to bush. When then 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. 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 gallædiplopappi* 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.

***Praise Him in His name Jah and rejoice before Him. Psalm lxviii: 4.**

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 Cicindelidæ 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 sidelines 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.

INSECTS OF THE SEASON IN ONTARIO.

L. Cæsar, O. A. C., Guelph.

With a few exceptions there have not been many complaints this year of serious injury from insect pests.

Orchard Insects.

Codling Moth (*Carpocapsa pomonella*). Each year, even in the most favorable localities for development, adds to the number of those who are proving that one thorough spraying just after the blossoms fall will control this pest. There is no doubt that in old apple orchards the use of gasoline outfits with high pressure has been one of the main factors in obtaining this result. The percentage of infestation this year was high in a few of the warmer districts, due rather to the crop of apples being much smaller than usual than to any excessive number of the insects themselves.

San José Scale (*Aspidiotus perniciosus*). A good many complaints of damage being done by this, our worst insect pest, have been received. This was largely due to the difficulty last spring of getting on the land in time to spray affected trees thoroughly. In some cases old orchards were not pruned and scraped before spraying and consequently it was impossible to do a good job. In a few cases the mixture used may have been too weak.

Plum Curculio (*Conotrachelus nenuphar*). This insect was not nearly so prevalent as usual in most parts of the province, though in some neglected apple orchards in Prince Edward County it was very abundant and had attacked most of the fruit. The surroundings here were specially favorable.

Apple Curculio (*Anthonomus quadrigibbus*). In several localities I found apples punctured by this pest but the total number affected was small. It is evidently a rare insect in apple orchards in Ontario.

Leaf-Rollers (*Archips* spp). From Durham County complaints of damage to apples from so-called "Green Fruit Worms" have been received. On questioning more closely I found that it was not this insect but Leaf-rollers that were responsible. Arsenical sprays are not so satisfactory against these as one could wish, but the total damage done does not, I think, warrant any special treatment. The most common species seems to be *Archips rosaceana* and not *A. argyrosphila.*

Lesser Apple-Worm (*Enarmonia prunivora*). I have been considerably surprised to see that a large percentage of the so-called Codling Moth injuries to fruit in Wellington County this year has in reality been caused by the Lesser Apple-Worm. This pest is, as mentioned in previous years, very common in haws.

Tent-Caterpillars (*Malacosoma* spp.). Both the American and Forest Tent-Caterpillars have spread widely since last year. The former species is now becoming abundant in some counties west of Toronto. East of Toronto and especially from about Trenton on down the St. Lawrence River both species are very numerous and have done much injury to fruit trees. Several kinds of forest trees, especially maples and poplars, have also been severely attacked. From Morrisburg in August I brought to Guelph a number of clusters of egg masses to test how severely these were parasitized. Only about 20 parasites emerged and an examination of the clusters seemed to indicate that the prospects for another serious outbreak next year were only too good. No well sprayed orchard either last year or this year has suffered from these pests. In this connection it is very interesting to learn that the regular spring strength of lime-sulphur applied soon after the caterpillars emerge from the eggs, which is about the time of the opening of the buds, destroys almost all those hit, no arsenical being necessary. This was well tested by Mr. Bradt near Morrisburg on fourteen apple trees, two other trees being left as a check.

Fall Cankerworm (*Alsophila pometaria*). For the last two or three years this species of Cankerworm has been very abundant and destructive in the County of Wentworth. Wherever the orchards are cultivated and well sprayed it is kept under good control, but many neglected orchards are defoliated. Judging from the number of females to be seen throughout November there will be numerous caterpillars again next year. In the County of Haldimand there is another colony of this insect but I have no report as to the amount of damage being done.

Aphids. These insects have not been general throughout the province this year but in some localities apple trees have been severely attacked. On the whole I should call it an average year for aphids on all kinds of fruit trees and shrubs. Fruitgrowers are more familiar with the injury they do and are more easily alarmed than would have been the case a few years ago.

Apple Maggot (*Rhagoletis pomonella*). There has been a remarkable diminution in the number of this apple pest, probably due to the excessive moisture and low temperature of the summer and autumn of 1912. I have now discovered its presence in sixteen counties thus showing that it ranges from the extreme east near Ottawa to the west near Sarnia. It is evidently not nearly so serious a pest as it formerly was thought to be.

Buffalo Tree-hopper (*Ceresa bubalus*). Specimens of apple branches severely attacked by this insect have been received from time to time, but apparently there is no special increase in its numbers.

Capsids. Fewer complaints than usual of injury to fruit have been received. An exception should be noted of some badly deformed apples forwarded from the office of the district representative at London, with the statement that the whole orchard was affected in the same way. I hope, if possible, to visit this orchard next spring and determine the species responsible.

Apple Tree-borers. From St. Joseph's Island and the adjacent mainland there are complaints of serious damage from borers which attack both nursery and orchard trees. These and winter injury are the two great foes to the fruit industry in those parts. I was not able to obtain specimens either of the larvæ or adults but was informed that both the Flat and Round-headed species were at work. The presence of so much forest may be the explanation of the greater degree of injury in these parts.

Bud Moth (*Tmetocera ocellana*). The effect of our ordinary methods of spraying apple orchards upon the control of this pest was excellently illustrated by two orchards south of Hamilton. One of these has been well sprayed three times each year for several years and scarcely any bud moth larvæ could be found; the neighboring orchard about 200 yards away is neglected and is very severely attacked, worse than I have ever seen an orchard before.

Cherry Fruit Flies (*Rhagoletis cingulata and R. fausta*). These flies though moderately abundant were not so numerous as in 1912. We have not yet been able to determine how widely they are spread throughout the province, but have proven that they are to be found all through the Niagara district and are much more destructive than has been supposed. We have worked out their life histories and means of control with the exception of a few minor points. Next year we hope to give a full account of them.

Shot-hole Borer or Fruit Tree Bark Beetles (*Eccoptogaster rugulosus*). This species of Ipidae seems to be on the increase again. A peculiar or to me new form of injury from it was the destruction of the terminal part of numerous twigs on Sweet Cherry trees near Fonthill. At first sight I felt sure from the dead leaves that the trouble must be due to Brown Rot, but an examination showed that the beetles had bored into the twigs and caused the death of the part beyond.

European Red-Spider (*Tetranychus pilosus*). For some time I had suspected that a good deal of the so-called Red Spider work could not have been caused by *Tetranychus bimaculatus*. Specimens of the mite were captured and sent to Mr. Nathan Banks who at first thought they must be the Southern Red Spider (*Tetranychus mytilaspidis*) which had escaped from citrus plants in the greenhouse, but on my sending him more material he identified them as the European species, not hitherto reported in North America. This species is most common on European plums but is also found on apples. It probably occurs on many other kinds of fruit trees also though I am not sure of this. I have found it on plums from Forest to Bowmanville, and from Guelph down to Fonthill, so that it is very widely spread and must have been in the province many years. It is I believe more destructive to plums than the ordinary red spider, being apparently much more abundant on these.

PEAR PSYLLA (*Psylla pyricola*). There have been very few Psyllas seen in the province this year, though here and there complaints of their presence have been reported.

PEACH TREE BORERS (*Aegeria pictipes, Sanninoidea exitiosa*). In the Niagara district a good many peach trees have cankers on the branches caused by the so-called "Gummosis" disease. These wounds have given opportunity for the entrance of borers, apparently the Lesser Peach-borers. From some of the new peach districts of Elgin and Norfolk complaints of injury from *Sanninoidea exitiosa* have also been sent in. In the Niagara district this insect is not often very abundant.

BUSH FRUITS.

IMPORTED CURRANT-BORER (*Aegeria tipuliformis*). Nearly every currant plantation is becoming badly infested with this pest. It looks as if better suggestions for control are badly needed.

RED SPIDER (*Tetranychus bimaculatus*). One of the main causes for the early dropping of currant foliage is the attack of numerous Red Spiders. Nearly every plantation I examined in the Niagara district was affected by these mites.

RASPBERRY ROOT-BORER (*Bembecia marginata*). Old plantations of raspberries in Niagara are severely attacked by this insect. The remedy would appear to be the plowing up of badly infested plots late in autumn after all the eggs have been laid. All roots should of course be collected and burned. This is not a very difficult task. Ploughing as soon as the crop is off would also be satisfactory as the adults have not then emerged but the growers are usually too busy.

VEGETABLES AND FIELD CROPS.

PEA APHIS (*Macrosiphum pisi*). There have been very few complaints of injury from these aphids for three years. In south-western Ontario they have been troublesome again in a few localities this year.

CABBAGE APHIS (*Aphis brassicae*). This pest is again becoming abundant in many parts of the province but is not yet nearly so destructive as it was about five years ago.

ONION MAGGOT (*Pegomyia ceparum*). Many plots of onions have been badly infested with this maggot. Nothing more satisfactory in the way of control has apparently been discovered than Cook's carbolic wash, though this is by no means an easy or entirely efficient remedy.

PERILLUS BIOCULATUS, var CLAUDUS. We are pleased to be able to report the continued presence of this friend in our midst. Whether owing to its aid or some other cause or both, the potato beetles were so effectively kept under control in a number of fields that spraying for them was not necessary.

ASPARAGUS BEETLES (*Crioceris asparagi* and *C. 12-punctata*). Both these insects are now widely spread through the province. The former occurred in

enormous numbers on a field of asparagus examined during the cutting season near Niagara Falls. Sometimes a single shoot would have 40 or more adults on it and numerous eggs. They are not uniformly abundant in the province each season as they vary greatly in numbers from year to year.

GRASSHOPPERS. In spite of the moist weather of 1912 grasshoppers have been very numerous and destructive in Norfolk County this year. The complaint is made that none of the remedies recommended are giving satisfaction. Serious losses for several years in that county have led to requests for a thorough study of the pest.

HESSIAN FLY (*Mayetiola destructor*). I hoped that the wet weather in 1912 and the late sowing of the wheat would have done much to check the Hessian Fly. These probably did help some but the insect has caused a considerable amount of loss this year again.

FOREST AND SHADE TREES.

SPRUCE GALL-LICE (*Chermes similis* and *C. abietis*). In most districts visited this year there was good evidence to show that some cause was operating to control these two pests. In most cases there had been very few new galls formed this year.

THE EUROPEAN FRUIT LECANIUM (*Lecanium corni*). This scale is remarkably abundant at present on Elm trees in the Niagara district. It has also on several occasions been sent in on Blackberry canes, these being almost covered. Fruit trees in a few localities are moderately infested.

About six years ago this same scale was very prevalent but from some cause, probably parasites, it almost disappeared. I observed that a considerable percentage of the scale this summer showed the emergence holes of parasites so that we are hopeful it will not prove very destructive.

THE TERRAPIN SCALE (*Eulecanium nigrofasciatum*). This once much dreaded pest is still to be seen quite abundant on Soft Maples at St. Catharines and some other places. No trees, however appear to have been specially weakened. The scale is heavily parasitized. I have not yet seen it on any fruit tree.

ENGLISH WALNUT SCALE (*Aspidiotus juglans-regiae*). Many people seeing this circular scale on shade trees and mistaking it for San José Scale have been alarmed lest the cities may be denuded of their deciduous trees. This fear is of course not justified as the scale is not nearly so prolific as the San José and is also quite heavily parasitized, it being a common thing to find 50 per cent. of the insects with parasite emergence holes in them. The Soft Maples are much infested with the English Walnut Scale in St. Catharines and to a lesser extent in many other places. We have also found some species of poplar severely attacked.

An interesting scale insect was found in 1907 by Prof. Jarvis on willows at Collingwood and again by me this year on the same kind of plants at St. Catharines. The Washington experts believe this to be a cross between *Aspidiotus juglans-regiae* and *A. ostreaeformis*.

THE IMMATURE STAGES OF THE TENTHREDINOIDEA.*

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An interest in the study of the adults of the Tenthredinoidea has emphasized the necesity for some knowledge of the immature stages. The differentiation of species from adult characters is at times a difficult one. It is frequently found that species closely related and difficult to separate as adults have larvæ that are not only very different structurally, but also in their habits. It was hoped from a study of the immature stages of the Tenthredinoidea that some information might be obtained as to the validity of the species based on obscure anatomical details. This opportunity came through the offer of the Maine Agricultural Experiment Station to collect, breed, and study the Tenthredinoidea of Maine during the summer of 1913.

In all phylogenetic studies the groups marking the beginning of things are always not only of the greatest interest, but of the greatest importance, because a study of their structures always shows something as to the origin of the structures found in the higher, more specialized groups of the same order. The superfamily Tenthredinoidea is such an order, so that any morphological study of the forms included within this group should be of particular interest. It contains the most generalized species of the order Hymenoptera, and has been considered by all students of the order as the most primitive group.

The adult insects of this superfamily have the proximal segments of the abdomen similar in form and the abdomen broadly joined to the thorax as in the beetles or locusts. Among all other groups of the Hymenoptera, the conditions are very different. There is a deep constriction between the first and second abdominal segments. The construction is so deep that many systematists have considered this as the point of separation between the thorax and the abdomen. The true first abdominal segment is completely fused with the metathorax and the spiracles borne by this segment, usually considered as the metathoracic spiracles, are the spiracles of the first abdominal segment. This constriction between the first and second abdominal segments of the adult arises during pupal life and is used to separate the Hymenoptera into two distinct groups.

These groups are usually designated as suborders by systematists. To the one including the Tenthredinoidea, the early students of the order gave the name of Phytophaga, from the fact that their larvæ are all plant feeders. The later workers, however, have adopted the name of Chalastogastra, based on the structure of the base of the abdomen. These terms are co-extensive with the superfamily name Tenthredinoidea as here used.

The early systematists divided the group into two families, the Tenthredinidæ and Uroceridæ, the saw-flies and the horn-tails. This grouping was followed for many years, but has been quite generally discarded now. The English entomologist, Peter Cameron, was the first to subdivide these families. He recognized four families, Tenthredinidæ, Cephidæ, Siricidæ, and Oryssidæ, which were subdivided into subfamilies and tribes. These additional families are a result of a splitting of the family Uroceridæ, now known as the Siricidæ through the displacing of the generic name *Urocerus* by *Sirex*.

*Contribution from the Entomological Laboratories of the University of Illinois, No. 38, and Papers from the Maine Agricultural Experiment Station: Entomology No. 70.

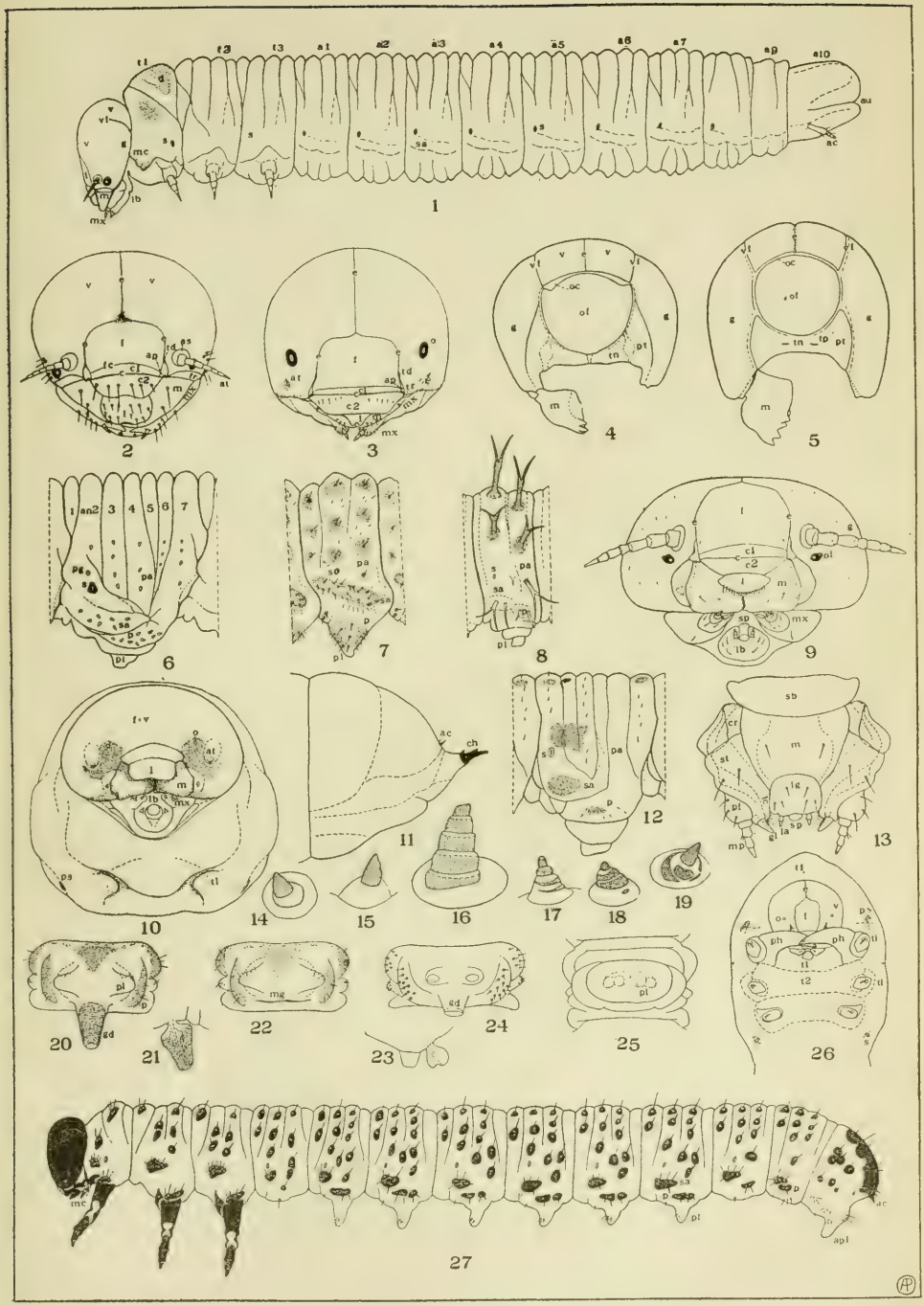

PLATE 1.—Immature stages of the Tenthredinoidea.

Various subdivisions and combinations have been proposed by modern writers. Konow in 1890, recognized a single family divided into three subfamilies and these in turn divided into eleven tribes. Dalla Torre in his Catalogue, recognizes one family and eighteen subfamilies. A still different grouping is that of Ashmead, published in 1898, where eighteen families are recognized, but different in extent from those of Dalla Torre. The most recent grouping is that of Rohwer, who would divide the group into four superfamilies. These superfamilies comprise fourteen families, and one of these families, the Tenthredinidæ, includes eleven subfamilies. In the following paper the classification proposed by the writer in 1906, based on a phylogenetic study of the wings, has been followed, in which a single superfamily and nine families are adopted. Representatives of the families Blasticotomidæ and Megalodontidæ are not found in America, and they are not considered in any reference in the following pages to the group as a whole. These families would be grouped as follows:—

The generalized Tenthredinoidea.

- The vein R_2 conservers ..... *Xyelidæ*
- The vein R_2 losers ..... *Pamphiliidæ*

The specialized Tenthredinoidea.

- The cell R_4 group.
  - Primitive cell R_2 conservers ..... *Blasticotomidæ*
  - Primitive cell R_2 losers ..... *Tenthredinidæ*
- The cell R_5 group.
  - The radial cross-vein and M_2 conservers.
    - The Medio-cubital cross-vein conservers ..... *Xiphydriidæ*
    - The medio-cubital cross-vein modifiers.
      - The M and *m-cu* equalizers.
        - The Cell $C+c_1$ losers ..... *Siricidæ.*
        - The cell $C+Sc_1$ conservers ..... *Megalodontidæ.*
      - The M and *m-cu* modifiers ..... *Cephidæ.*
  - The radial cross-vein and M_2 losers ..... *Oryssidæ.*

The great difference in the number and rank of the groups is due in the main to the difference in opinion as to what position shall be assigned the components of the restricted family Tenthredinidæ. This family contains a large complex of genera that are readily segregated into a number of definite groups that are easily differentiated by means of structural characters, but they all have a similar or common habitus. The writer believes that these groups are best handled by considering them simply as subfamilies. In the work referred to above, twenty-four subfamilies are listed. Of these, the following are found in the United States and Canada:

Contraction of the anal cell conservers ..... *Lophyrinæ*
Emphytinæ
Selandriinæ
Dolerinæ
Phyllotominæ

Contraction of the anal cell losers.

Anal cell conservers.

Second anal vein conservers ..... *Lycaotinæ*
Tenthredininæ
Cimbicinæ

Second anal vein losers.

Second anal cell reduced by atrophy.

Costal area conservers.

Radial cross-vein conservers ..... *Hoplocampinæ*
Dineurinæ

Radial cross-vein losers ..... *Monocteninæ*
Cladiinæ
Nematinæ

Costal area losers ..... *Blennocampinæ*
Fenusinæ
Scolioneurinæ

Second anal cell reduced by coalescence ..... *Hylotominæ*
Schizocerinæ

Anal cell losers ..... *Acordulecerinæ*

There are many facts in the development of the Tenthredinoidea of great interest. One of these is the method of reproduction of many of the species. A great variation exists in the number of individuals of the two sexes; in only a few species are the males as numerous as the females. The males, while frequently differently colored, do not ordinarily differ markedly in structural characters, though they are usually smaller in size. The number of males is always less, not only among captured, but among bred individuals. Males are unknown in certain species, while in others, where the males are known, the females reproduce parthenogenetically. Practically none of the American species have been experimented with from this point of view, but much has been written with regard to the European forms. Von Siebold has shown that males are unknown for about one-fifth of the German species and Cameron that they are unknown for about one-third of the British species. The fact that no males are known for any given species does not signify that the species reproduces only parthenogenetically, for many of the species are rare, in many cases only a few individuals have been collected, the number of males is always much less than that of the females, so that the possibility of the collection of males is much less. It has, however, been shown conclusively by many different investigators that eggs laid by virgin females of certain species will produce larvæ. The parthenogenesis is a mixed one, for among the known parthenogenetic species males are known for certain species and in the case of these species larvæ may be produced from eggs laid either by virgin females or impregnated females. The conditions would suggest that the parthenogenesis was a progressive one, for in certain species the eggs laid by virgin females produce both males and females, in others only males, and in still others only females. The known parthenogenetic species all belong to the family Tenthredinidæ. *Pteronus ribesii* and *Lygaeonematus erichsonii* are well known examples.

The eggs are always laid by the female within the tissue of the host plant. Where the larvæ are borers, Xiphydriidæ, Siricidæ, Cephidæ, and Oryssidæ, they are laid in holes bored in the stems of bushy plants or in the limbs or trunks of living or recently dead trees. Where the larvæ are leaf-feeders, the eggs are placed in slits sawed by the female from the under surface and located between the two layers of parenchyma. A few species insert their eggs in the petiole of the leaf, some of the gall-making species in the leaf-buds, and *Hoplocampa cookei* in the blossoms of cherry on the sepals or the upper part of the calyx cup. The eggs are oval in outline, flattened, usually white in color, though sometimes bluish or greenish, and very difficult to locate when first laid. They swell after a short time, varying with the species, to twice their original size and push out the surface of the leaf so that it appears to be covered with little mounds. The end of the egg may project from the slit at this time. The cause of the swelling is unknown.

The number of eggs laid in a single leaf varies greatly. A large majority of the species distribute their eggs over the adjacent leaves of the host plant, one or two in a leaf, and some, if one may judge from the distribution of the larvæ collected, on widely separated bushes. Some species on the other hand lay a large number of eggs within the same leaf, as in the case of *Macremphytus varians,* thirty or forty, distributing them generally over the under surface, while in *Pteronus fulvicrus* there are usually about twenty placed in a group at the extreme tip of the leaf.

The eggs are usually located along the larger veins, as in *Pteronus ribesii* or along the margin of the leaf. In *Macremphytus* they are placed near the secondary veins, but in *Pteronus fulvicrus, Cimbex, Trichiosoma,* and many of the species whose larvæ are leaf-miners, the veins are disregarded. From twelve days to three weeks are required to complete the embryonic life. The young larvæ issue through the slit made in the leaf by the female in inserting the egg.

The length of the feeding time of the larval life varies considerably with the species. There are five to seven instars, the number being different in the different groups, which usually require about fifteen days, sometimes as few as twelve in some species, and as many as twenty or even more in others.

Each species is quite constant in its method of feeding; that is, whether the larvæ feed singly, solitaire, or a number together, gregarious. The way in which the eggs are placed by the female has much to do with this. In no species where the eggs are well distributed has it been noted that the larvæ were other than solitary feeders, but in *Macremphytus,* where many eggs are laid in a group, the larvæ feed gregariously for the first half of their life and solitary for the last half, while in *Pteronus fulvicrus,* where the eggs are also laid in a group, the larvæ are gregarious throughout their feeding period. An apparent exception is found in the case of the larvæ of the Lophyrinæ, where a number of eggs are placed in the needles at the apex of a single branch and the larvæ become gregarious through the consumption of the adjacent needles.

The manner of feeding is strikingly varied. In many nematids and hoplocampids, the young larvæ as soon as they emerge from the egg eat holes through the leaf and continue feeding around the circumference of the hole, clinging to the leaf with their thoracic legs and holding the body S-shaped in the hole. When a number of eggs are placed adjacent to each other, the larvæ continue this method, feeding until this portion of the leaf is devoured, and then they migrate to another part of the leaf or an adjacent leaf and are edge feeders for the remainder of

their feeding life. Some species are leaf-skeletonizers for the first two or more instars and then either feed from the edge or eat holes in the leaf. The great majority of species are edge feeders. In some groups, as the Nematinæ and Hoplocampinæ, the larvæ cling to the edge of the leaf with the thoracic legs and with the abdomen lying against the edge of the leaf, but free. There are exceptions even in these subfamilies, for some of the species cling to the upper or lower surface of the leaf, as *Pteronus thoracicus,* which feeds stretched out flat on the upper surface and holds itself in place with the thoracic legs. The Emphytinæ and Selandrinæ rest stretched out flat on the under surface and feed at the edge or eat holes in the leaf. Some of the species of these subfamilies throughout their feeding period and others as they approach the end of their feeding period curl themselves up into a ring or helix-like and cling to the under surface of the leaf with their thoracic legs. The Phyllotominæ are leaf-skeletonizers throughout their feeding period and feed from the under surface. They remove only the lower parenchyma. Most Cladiinæ are also leaf-skeletonizers, but they remove everything but the larger veins. The Pamphiliidæ feed both solitarily and gregariously. The solitary feeders roll the edge of a leaf, tying the folds together with silk, forming a case open at each end, in which they live and feed upon the edge of the leaf. The gregarious feeders tie several leaves together with silk, forming an irregular nest and feed upon the enclosed leaves. The larvæ of this family are the only members of the superfamily that spin silk other than for the formation of the cocoon, that occur in the United States or Canada. The larvæ of *Cimbex* and *Trichiosoma* cling to the dorsal surface of the leaf with their thoracic legs and feed on the edge of the leaf; when not feeding they rest with the body curled helix-like. The members of the subfamily Lophyrinæ feed on various species of conifers; they clasp the needles between the thoracic legs and feed at the free end. The larvæ feed on the needles until only short stubs are left and then migrate to others, so that, while the eggs are placed singly or only a few in a needle, they become gregarious in the latter part of their feeding period from the consumption of the greater part of the needles on the branch. Some species will feed only on the needles of the year old growth, others are indiscriminate, feeding either on the new or the old growth. None of the larvæ of the Dolerinæ have been absolutely identified for the American species. What are believed to be larvæ of this subfamily are grass and sedge feeders. They usually occur singly or several individuals on the same stem, clasping it with their thoracic and abdominal legs. The Acordulecerinæ feed only on the under-surface. They are gregarious, arrange themselves in a file along one side or across the end of the leaf and feed toward the stem, leaving intact the larger veins, so that the tip looks badly frayed. The frayed leaves seen commonly in July and August, on oaks is the work of the larvæ of this subfamily. The species that I have studied are double brooded. The Scolioneurinæ and Fenusinæ are leaf-miners and feed in blotch-mines in the leaf.

The larvæ that cling to the edge of the leaf with the thoracic legs are rarely easily jarred from the host plant. The same is true of a number of those species that have the thoracic legs well developed and cling to the surface of the leaf. The larvæ of the Emphytinæ and Selandriinæ are very easily disturbed. It is impossible many times to turn over a leaf containing a larva in order to examine it without its dropping to the ground and coiling itself up into a ball that is usually difficult to locate. The larvæ of *Macrophya* and *Tenthredo* also have this same habit. The most sensitive larva that I have examined is one that is found

on the Tall Meadow Rue (*Thalictrum polygamum*), where it feeds on the white flower clusters. These larvæ will drop to the ground when one is four or five feet from the plant on which they are feeding. When they reach the ground they curl themselves up in a ball. The adult has not been bred. In striking contrast to this larva is that of *Dimorphopteryx,* which feeds resting upon the upper surface of the leaves of birch, linden, maple, black oak, and shadbush. It is impossible to shake these larvæ loose and difficult sometimes to pull them loose with the forceps.

The larvæ of certain genera and subfamilies of Tenthredinidæ are entirely different in appearance during their last larval period; white larvæ may become spotted, the spotted white or green, and the spiny spineless. When the larvæ are through feeding, they cast their skin, which may take place either before or after leaving the host plant. It is the period during which they are preparing for pupation. For one who has not observed the differences found at this time it is difficult to appreciate the change that takes place. My first experience was with a larva that was glazed white when I examined it in the afternoon; the next morning the breeding cage contained almost entirely larvæ that were white with small irregular black patches. This stage has been named by Dr. H. G. Dyar, who has done more than all the other American workers together in elucidating the transformations of the Tenthredinoidea, the ultimate stage. The assumption of an ultimate stage does not seem to be peculiar to subfamilies or genera. The modifications in color and structure will be discussed more fully later.

There is considerable variation in the method adopted by the larvæ in preparing for pupation. The Xyelidæ and Pamphiliidæ transform in cells in the ground. The species of Emphytinæ and Selandriinæ for the most part bore into rotten wood; this is particularly true of the species that feed on different species of ferns, of which there is a considerable number. These larvæ will transform in absolutely no other way. They will travel round and round a breeding cage for days searching for the rotten wood, and if placed upon a piece, will be out of sight within it in a few minutes. They cut a smooth, straight tunnel of the same diameter as their bodies and plug the open end with the dust from their cuttings. The tunnel is usually not lined with silk, although a few species prepare a very slight silken lining. All the species of *Macremphytus, Emphytus, Strongylogastroidea, Strongylogaster,* and *Taxonus* transform in this way, also a few nematids. The larvæ of the Blennocampinæ, transform in cells in the ground. The Lopherinæ, Dolerinæ, Phyllotominæ, Tenthredininæ, Hoplocampinæ, Hylotominæ, and most Nematinæ transform in cocoons just beneath the surface of the ground and in the breeding cage will form their cocoons, if no soil or trash is provided, on the bottom or side of the jar. Some Lophyrinæ, also *Cimbex* and *Trichiosoma,* sometimes attach their cocoons to the host plant. The cocoons of all these groups except the Hylotominæ are brownish or blackish in color and dense in structure, the cocoons of the Hylotominæ on the other hand are white and lace-like and appear much larger in size in proportion to the size of the adult. The cocoons of the Acordulecerinæ are minute, dense, and opaque white in color, and are probably placed just beneath the surface of the ground. They were made among the debris of the food material in the bottom of the cage. The Scolioneurinæ and Fenusinæ leave their mines and enter the ground, where a part of the species at least form cocoons. The larvæ of the Xiphydriidæ, Siricidæ, Cephidæ, and Oryssidæ transform in their tunnels, some, if not all,

forming cocoons. Most of the larvæ of the genus *Pontania* which form galls or abnormal growths on the leaves of *Salix* and *Populus*, leave the galls and transform in cocoons in the ground, in rotten wood, or in the pith of plants, differing with the species. Some of the species leave their galls and evidently crawl over the bush and enter the vacant galls of cecidomyiids or of other individuals of the same species, where they transform. Practically all the adults of *Pontania pisum* that I have seen were bred from cecidomyiid galls collected on *Salix*. The larvæ of *Euura*, which form galls on the stems of *Salix*, transform in cocoons either in the galls or enter the ground. The larvæ of the Cladiinæ transformed in the breeding cages in cocoons made of a thin, transparent, homogenous sheet of silk formed between the leaves of the food plant. In nature they probably transform in the ground.

In most insects with a complete metamorphosis that transform in rotten wood, in cocoons, or in cells in the ground, the body of the larva becomes shortened while preparing its place for pupation and almost immediately after its completion, a few days at the most, the last larval skin is shed and the pupal condition is assumed. A very different condition is found in the Xyelidæ, Pamphiliidæ, and Tenthredinidæ. The most of the species are single brooded, that is, the larvæ emerge early in June, complete feeding by the end of the month, enter the ground or rotten wood, spin cocoons, and the adults emerge the following April or May. Writers in referring to the transformations of species of these groups frequently state that they pupated at a certain date, referring to the time when the larvæ entered the ground or rotten wood. Such a statement is incorrect, for in all the species so far as known, the insect lives as a larva until the following spring, March or April, or even later. The pupal period is, therefore, very short and many of the metamorphic changes must take place during this quiescent period of the larva. The larvæ of the leaf-feeders, if one may judge from breeding cage experiences, have many idiosyncrasies. Just before they are ready to cast their larval skins and become pupæ, they may leave their cocoons or earthen cells or their tunnels in rotten wood and force themselves to the surface of the soil, where they will remain as if dead, only wriggling the body when disturbed. Such larvæ may pupate on the surface of the soil and produce adults or they may die. The larvæ are very subject to the attacks of hymenopterous and dipterous parasites, but in no case observed did any of these larvæ produce parasites.

The pupæ are typically hymenopterous in type, the antennæ, legs, and wings are enclosed in separate cases, the wings are pad-like in structure. The pupæ are ordinarily green in color, becoming darker with age, sometimes with yellow or orange spots. The pupal state lasts about twelve or fifteen days. The adults when they emerge from the pupal skin remain in the place of pupation until the wings are fully expanded and the cuticular parts hardened. They emerge from the cocoon by roughly cutting out one end; but in the Lophyrinæ and *Cimbex* and *Trichiosoma* a neat lid is cut and is left attached to the cocoon.

With the exception of the Tenthredinidæ, all the species are clearly single brooded. While many of these are single brooded, others apparently have more than one brood. Any statement as to the number of broods should be made with care. It is a well known fact of observation that many species of insects, probably a large majority, appear at a stated time, the males frequently a few days before the females, a week or ten days covering the entire period. This is not true in this family, for adults may appear over a period of four to six weeks, so that with some species, full grown larvæ and just emerged

larvæ may be found on the same leaf. Some of the first larvæ to emerge may have matured, pupated, and produced adults. For the sake of convenience, the females developed from wintering larvæ may be designated, as spring emerging females and those developed from larvæ produced the same summer as summer emerging females. The small larvæ found on the same leaf with the almost mature larvæ may have been produced from eggs laid by late maturing spring emerging females or they may have been produced from eggs laid by a summer emerging female. There results field conditions that would warrant the considering of the species as single brooded, while breeding experiments would show two or more broods.

It is a matter of record that there is a second lot of larvæ produced in the case of *Pteronus ribesii, Lygaeonematus erichsonii, Taxonus nigrisoma,* and various species of *Lophyrus.* The number of larvæ produced at this time is always much less than the number produced by the spring emerging females. There is no question but that in many species, only a small number of the larvæ produced by the spring emerging females pupate the same season and emerge as adults; the great majority do not emerge until the following spring. So that in most species a full second or third brood does not exist.

That the great majority of the species of Tenthredinidæ are single brooded and the other species partial second or third brooded is also shown by the collection of adults. They are most abundant during six weeks or two months of the spring, May and June or June and July, depending upon the latitude and the altitude of the region. Only a few individuals are taken after this period, as is shown by the many collections that have been received for identification and my own collecting during the past twenty years. The adults are usually taken flitting about on or near the host plants upon which the larvæ feed. They are found more abundantly during the early part of the forenoon in sunny places. The great majority of the species are peculiar to the boreal and transitional zones, but in the east and middle west extend into the upper austral zone. A limited number of species extend into the lower austral, while the subfamilies Hylotominæ, Schizocerinæ, Acordulecerinæ, and certain genera of *Selandriinæ* find their greatest development in tropical regions.

The food-plants of the larvæ are, therefore, for the most part such species as are peculiar to the boreal and transitional zones. The various conifers, species of *Salix, Alnus, Betula, Quercus,* various genera of filices, *Populus, Viburnum,* and *Sambucus* harbor the largest number of species. The species of *Cornus, Corylus, Fragaria, Carya, Rumex, Ulmus,* and the various kinds of sedges are next in importance, while the following are the more important of the remaining host plants: *Amelanchier, Fraxinus, Pyrus, Crataegus, Rosa, Prunus, Rubus, Viola, Robinia, Acer, Juglans, Tilia, Carpinus, Ostrya, Polygonum,* and *Vitis.*

Before the taxonomy of any group can be accurately determined, the structure of the forms to be grouped needs to be carefully examined. But little has been done in homologizing the parts of the external skeleton of the larvæ of any of the orders with a complete metamorphosis and practically nothing has been written dealing with the anatomy of the larvæ of the Tenthredinoidea. This is sufficient reason for a somewhat detailed discussion of their external anatomy.

The larvæ of the Tenthredinoidea, with the exception of the leaf-miners, are cylindrical in form (Figs. 1 and 27), caterpillar-like. They consist of a well differentiated, globular head and a series of similar segments. The segments are clearly indicated and the thoracic segments can be distinguished by their form

and position in the legless species and by the presence of true thoracic legs in the remainder. The larvæ of the leaf-miners are usually depressed, the body is moniliform with the head depressed and triangular in outline.

The entire head and body, as is common with all insects, are covered by a sheet of cuticle, which is thin and transparent in many species of Tenthredinoidea. It is so transparent in some species that the form of the dorsal vessel or heart, the alimentary canal in part, the air-tubes or tracheae, and the form and location of a part of the masses of adipose tissue or fat, can be determined in the living animal.

The head (Fig. 27), except as specified above, is globular in outline and the mouth directed ventrad or caudad. The external head skeleton, the head capsule, is strongly chitinized, fixed in form, and not readily changed from its natural shape. The shape and hardness of the head distinguish it from the remainder of the body. The only other difference worthy of note is found in the genus *Dimorphopteryx,* where the head is distinctly triangular in outline. The head in the Xyelidæ, Pamphiliidæ, and Tenthredinidæ is fully exposed, but in *Cephus* and *Tremex* (Fig. 10), a condition exists which is probably characteristic for all the boring larvæ. The cephalic part of the prothorax on the dorsal and lateral aspects is produced into a broad fold which conceals the caudal part of the head. This condition undoubtedly marks an early stage in the retraction of the head into the thorax, so characteristic of many of the larvæ of the higher Hymenoptera. The parts of the head may be divided into two classes, the fixed parts and the movable parts.

The fixed parts of the head comprise all the immovable parts of the head skeleton. The surface of the head skeleton may be entirely glabrous or with a few scattered setæ about the ventral margin as in *Pamphilius* or with numerous promiscuously arranged short setæ, more abundant on the ventral half of the head, as in *Tremex, Lophyrus, Caliroa, Abia,* and *Croesus* or with long setæ as in *Pteronus* or with numerous very long setæ as in *Trichiocampus.* The surface may also be polished, opaque, or roughened. If the surface is roughened, there can usually be recognized many closely placed quadrangular or oval areas with one or more central brownish spots. These areas are distinct in *Cimbex, Empria, Lagium,* and *Lygaeonematus.* They probably mark the location and extent of the hypodermal cells located beneath the cuticle.

There is a large opening in the caudal aspect of the head (Figs. 4 and 5, of) the occipital foramen, through which the alimentary canal and other organs pass from the head to the thorax. This opening can not be identified, except in a general way, until the head has been removed from the thorax.

In the heads of adult generalized insects, as the cockroach, there is a suture (Figs. 2, 3 and 9, e), the epicranial suture, extending from the caudal aspect of the head along the meson to the middle of the cephalic aspect, where it divides into two arms, which extend toward the compound eyes, making a figure shaped like an inverted Y. This suture can be identified on the heads of most Tenthredinoidea as a faint line, like a break in the cuticle in brown or black colored heads and as a slightly depressed line in opaque white colored heads. The compound eyes are wanting in larvæ and the arms of the Y after making a broad curve (Fig. 3, e) extend directly to the ventral margin of the head capsule. The exact course of the arms of the epicranial suture varies but little in different species. The stem of this suture originates at the occipital foramen (Figs. 4 and 5, of). In *Tremex* (Fig. 10), all parts of the epicranial suture are wanting.

Arising from the dorsal part of each lateral margin of the occipital foramen, there is on each side a furrow or suture, more distinct than the epicranial suture, which extends in a broad curve across the lateral aspect of the head to the cephalic aspect, where it becomes obsolete (Figs. 1, 4, 5, and 27, vf). These are the vertical furrows. They are not represented in lepidopterous larvæ. They are also wanting in the Scolioneurinæ and Fenusinæ and *Phlebatrophia,* which is a leaf-mining phyllotomid. In *Cephus* the vertical furrows are distinct, but do not project beyond the cuticular fold of the prothorax. They are also present in *Tremex,* but not so distinct as in *Cephus.*

The dorsal, lateral, and the greater part of the cephalic and caudal aspects of the head form a single area, the epicranium. This area is ordinarily subdivided into three definite areas, the vertex, the front, and the genae, but in larvæ and generalized insects the number is greater. In some species these areas or sclerites are surrounded by sutures; in others a part of sutures are wanting.

The shield-shaped area enclosed by the dorsal part of the arms of the epicranial suture is the front (Figs. 1, 2, 3, and 9, f). There is not much variation in the size or shape of the front; the most marked is as to whether it is as broad or broader than long. In *Scolioneura* the stem of the epicranial suture is only about one-half the length of the arms and the dorsal end of the front is an acute angle. The surface of the front is usually similarly sculptured to the adjacent parts. An exception is found in *Cimbex,* where it is roughened by irregular anastomosing lines.

The area on the dorsal aspect of the head included between the vertical furrows is the vertex (Figs. 1, 2, and 4, v). It extends ventrad on each side of the front to the ventral margin of the head and bears on its ventral portion the antennae (Fig. 2, at) and the simple eyes or ocelli. The vertex is divided into two distinct pieces by the stem and arms of the epicranial suture. The front and vertex are fused in *Tremex* through the obsolescence of the epicranial suture (Fig. 10). In lepidopterous larvæ there is a narrow plate, the adfrontal plate, formed by the fusion of a part of the tentorium to the ental surface of the vertex along the epicranial suture and extending as a narrow plate along each lateral margin of the front like an inverted V. This plate is wanting in the Tenthredinoidea.

The caudal portion of the head between the parts of the vertex on each side is occupied for the most part by the genæ (Figs. 1, 4 and 5, g). The genæ can not be considered other than as an area in these larvæ; there are no sutures separating it from the vertex. It is questionable whether it is ever more than an area of the vertex. The portion of the head between the eyes and the ventral margin of the head is usually designated as the genæ.

Between the genæ of each side and the lateral margin of the occipital foramen, there is a distinct triangular sclerite in *Pamphilius,* the postgenæ (Figs. 4 and 5, pt.). The apex of this triangle is located at the caudal end of a vertical furrow and its base forms a part of the ventral boundary of the head. The suture forming the lateral boundary of each postgena is not so distinct in *Cimbex,* and each postgena, while triangular in outline, extends only to the middle of the lateral aspect (Fig. 5).

There is a transverse suture in *Pamphilius* extending on the dorsal part of the caudal aspect of the head between the caudal ends of the vertical furrows, separating off a distinct sclerite, the occiput (Figs. 4 and 5, oc). This suture is subobsolete at the middle of its course and the occiput is distinctly constructed at middle. In *Cimbex* this suture extends on each side to the dorsal end of a postgena and

in no part of its course is it as distinct as in *Pamphilius,* while the occiput can be identified as a narrow band of cuticle closely fused with the vertex and genæ. There is no well marked suture between the occiput and postgenæ in *Cimbex.*

On the ventral part of the cephalic aspect, there is a distinct suture in both *Pamphilius* and *Cimbex* and related species connecting the ventral ends of the arms of the epicranial suture. This is the clypeal suture (Figs. 2, 3, and 9, c.), so named from the fact that it separates the two parts of the clypeus and should not be confused with the fronto-clypeal suture (Fig 2, fc), which will be described later.

Adjacent to the ventral margin of the front and the ventral ends of the arms of the epicranial suture there are several small sclerites. Just ventrad of the middle of each arm of the epicranial suture, there is a distinct pit, which marks the point of attachment of the dorsal arms of the tentorium (Figs. 2 and 3, td). At the ventral ends of the arms of the epicranial suture, there are also distinct thickenings, which mark the point of attachment on the ental surface of the head of the anterior arms of the tentorium. There are short sutures extending from the point of attachment of the dorsal arms of the tentorium to the clypeal suture. The small triangular areas (Figs. 2 and 3, ap) on each side enclosed by the sutures just named and the arms of the epicranial suture have been given the name of antecoxal pieces of the mandibles by Comstock. They do not so far as I am aware occur other than in the larvæ of insects with a complete metamorphosis and then only in the more generalized groups. In the ventral margin of each antecoxal piece, there is a distinct notch. This notch forms an acetabulum for the cephalo-mesal condyle of the mandible.

Along the ventral margin of the gena there is another small, transverse sclerite, which is also peculiar to generalized insects, but is found in both larvæ and adults. The mesal end of this sclerite (Figs. 2 and 3, tr) is adjacent to the antecoxal piece of the mandible. These sclerites have been named by Comstock the trochantins of the mandibles. They are well developed in *Pamphilius.*

In *Pamphilius* there is a faint transverse suture (Figs. 2, fc) extending from the middle of the suture forming the mesal boundary of an antecoxal piece to the corresponding suture of the opposite side. On the ventral side of this suture, there is a narrow transverse plate (Figs. 2, 3, and 9, c1), bounded on its ventral side by the clypeal suture. This narrow plate is the first clypeus and the plate along its ventral margin and separated from it by the clypeal suture is the second clypeus (Figs. 2, 3, and 9, c2). The faint suture extending between the antecoxal pieces and forming the dorsal boundary of the first clypeus is the fronto-clypeal suture. The second clypeus usually has its lateral margins oblique and its ventral margin emarginate. In many species of larvæ the fronto-clypeal suture is obsolete and the first clypeus is fused with the front, but in some the first clypeus has been greatly reduced in size and the clypeal suture becomes faint or obsolete and the fronto-clypeal suture is distinct. In generalized adult insects, the clypeus, so called, is a fusion of the antecoxal pieces of the mandibles, and the first and second clypeus; the lateral ends of the clypeal suture are frequently distinct and the mandibles are articulated with the lateral ends of the clypeus. This articulation is undoubtedly homologous with the articulation found in the antecoxal piece of the mandible described above.

There is a small movable flap, the labrum (Figs. 2, 3, and 9, l), attached to the ventral margin of the second clypeus. The labrum is usually emarginate along

its ventral margin; in some species the emargination is so deep as to almost divide it into two pieces. The labrum varies considerable in size and shape.

In the larvæ of insects with a complete metamorphosis, the eyes, if present, are represented by one or more simple eyes or ocelli, placed in a group on each lateral aspect of the head. The portion of the head capsule bearing this group of simple eyes is usually different in color or in sculpture. In order to differentiate this region from the adjacent parts, it has been designated as the ocularium (Fig. 9, ol). The ocularium in the Tenthredinoidea bears a single ocellus (Fig. 3, o). The presence of a single ocellus on each side of the head is the most useful character for differentiating the larvæ of the Tenthredinoidea from those of the Lepidoptera, which usually have five or six.

In certain larvæ the mouth is directed to the front and certain of the neck pieces fill the space on the ventral aspect of the head. The area, designated as the gula, is wanting in the larvæ of the Tenthdelinoidea.

The external head skeleton is supported by three pairs of pillars, which extend in different directions, and are known as the tentorium. The postgenæ are connected by a transverse bar, which extends within the cavity of the head. This bar is a part of the tentorium (Figs. 4 and 5, tn). It is known as the body of the tentorium. The place of attachment of two of the pairs of arms of the tentorium has already been described, the third is attached near the ends of the body of the tentorium (Fig. 5, tp).

The movable parts of the head comprise the antennæ, the mandibles, the maxillæ, and the labium.

The antennæ are inserted in round depressions, the antennal sockets, located on each side of the head near the ocularium. In *Pamphilius* (Fig. 2, as) they are placed between and a little above the ocularium and the front; in *Cimbex* (Fig. 3, at), between the ocularium and the ventral margin of the vertex, their usual location in the larvæ of the Tethredinidæ; and in *Tremex* (Fig. 10, at), they are located laterad of the ocellus, the ocellus being placed between the antennal sockets and the front.

The antennal sockets (Fig. 2,, as), are surrounded by a membranous ring in the Pamphiliidæ, but in all the other larvæ examined they are completely filled by the proximal end of the antennæ. The antennæ of the Pamphiliidæ (Figs. 2 and 9, at), are the most generalized in form. In this family they consist of seven segments and their length is equal to one-half the width of the head. In no other Tenthredinoidea examined do they approximate such a condition, while they may consist of as many as five segments, yet they are hardly more than mere tubercles in length. The fusion and reduction of the segments of the antennæ are gradual and are of value in showing the sequence of the groups. In the Emphytinæ, Dolerinæ, Selandriinæ (Fig. 16), and some others, they consist of five ring-like segments; in the Nematinæ (Fig. 18), they consist of transverse plates that appear to be closely appressed to the surface of the antennal socket, each plate is supplied with sensory setæ and represents an antennal segment; in the Acordulecerinæ there are only two of these plates; and in *Cimbex* (Fig. 14), they are reduced to mere blunt stubs.

As already noted, one of the condyles of each mandible articulates in an acetabulum in an antecoxal piece (Figs. 2 and 3), the other condyle articulates in an acetabulum on the caudal aspect of the head at the ventral end of the suture separating the gena and postgena (Figs. 4 and 5). The mesal margin of each mandible closes under the edge of the labrum and clypeus, is provided with prominent teeth, and together with the clypeus and labrum closes the ventral part of the head. (Fig. 9).

The caudal part of the mouth-cavity is closed by the maxillæ and labium. They form a transverse band with the labium in the centre and the maxillæ on each side (Fig. 9). The maxillæ of *Pamphilius* (Fig. 13) is the most generalized. Each contains a cardo (cr) consisting of two pieces, a proximal, quadrangular area and a distal triangular area. The cardo is bent at right angles to the stipes (st) and separated from it by a distinct suture. The ectal surface of the stipes is an oblique, strongly chitinized plate, which bears on the lateral margin of the distal part a prominent rounded shoulder, the palpifer (pf), which in turn bears a four segmented maxillary palpus (mp). The distal end of the stipes bears on its lateral corner a two segmented appendage, not so strongly chitinized as the other parts and with the distal segment bluntly and roundly pointed. This two segmented appendage is the galea (gl). The mesal margin of the distal end appears as a continuation of the ectal chitinzed plate of the stipes, much broader at its distal end than the galea and bearing a number of black setæ. This is the lacinia (lc), its form can be determined best from the ental surface. In the larvæ considered as standing higher in the series as *Cimbex*, *Trichiosoma*, *Macremphytus*, and *Croesus*, the same parts can be identified, but all the parts are soft and uniformly chitinized and without differentiation into sclerites on the ectal surface except by transverse folds. The maxillary palpus has fewer segments, two or three, and the lobe bearing the palpifer is expanded.

The labium (Fig. 13) in *Pamphilius* consists of a broad proximal piece, the submentum (sb), concave at its distal end, in which the transversely oval mentum (m) fits. The distal portion of the labium, the ligula (lg), bears a pair of segmented appendages on its distal end, the labial palpi (la). On the ental surface of the ligula and laterad of the labial palpi, there is on each side a protuberance, a paraglossa. Between the labial palpi and arising on the ental surface, there is a prominent lobe, which represents the glossa. The glossa has been modified into a spinneret (Figs. 9, and 13, sp.) for the opening of the duct of the silk glands. The spinneret in *Cimbex* and most other larvæ of the Tenthredinidæ, is located at the distal end of the labium. The shoulder bearing the labial palpi in *Pamphilius* is inconspicuous but is large and distinct in *Cimbex*, the labial palpi are also more prominent.

The head is usually a different shade of color from the remainder of the body. It may be entirely black, brown, green, white, or spotted. When spotted there appears to be a definite relation between the spots and the head areas, as the front, the dorsal part of the vertex, the genæ, and the ocularium. When the head is black, the minute ocellus, which is usually white, is readily identified. The ocularium in most of those larvæ where the head is pale, is a prominent, round, black spot with the ocellus placed at its centre or nearly so. (Figs. 1, 2, and 3). A common type of marking in the Nematinæ, where the head is usually green or white, is to have a fuscous shade along the parts of the epicranial suture and the vertical furrows. In the Emphytinæ and Selandriinæ the head markings are various combinations of a spot on the vertex between the vertical furrows, a spot including the ocularium and extending to the caudal margin of the head, and a spot on the front. The spot on the front may be wanting and the spot about the ocularium expanded until it meets the spot on the vertex, forming a broad black band around the circumference of the head and giving the head the appearance of being covered by a sun-bonnet. This was a common type among the supposed dolerid larvæ. The spots on the front and about the ocularium may be

reduced to a narrow, connected band forming a continuous mark across the lateral and cephalic aspects of the head. Larvæ marked in this way usually hold the head so that the black line coincides with the cut edge of the leaf. The second clypeus and labrum are usually of the same color as the head. In the black-headed species they are sometimes lighter or entirely pale.

The head is usually very pale in color immediately after moulting. If the head is normally green or white in color, this is not noticeable, but in the black or brown headed species it is strikingly so. In the Tenthredininæ, while some of the species have the head entirely green or white throughout their life, most of those studied had one or more black spots. These were located on the vertex, front, or genæ. Although usually coal black in color, they completely disappeared during the ultimate stage and the head became glassy green in color.

The region behind the head consists of thirteen segments, the cephalic three (Fig. 1, tl-3) belong to the thorax and the caudal ten to the abdomen (Fig. 1. a1-10). The thoracic segments are frequently more robust than the abdominal segments, while the tenth abdominal segment is quite different in shape from the others.

The thorax, while apparently consisting of three parts, is in reality a compound of four. The microthorax (Figs. 1 and 27, mc), the so-called neck, which is the segment bearing the labium, forms the cephalic part of the first segment of the true thorax. The folds of cuticle between the head and thorax conceal the microthorax for the most part, it shows as a darker colored V-shaped area along the cephalic part of the ventral margin of the lateral aspect of the prothorax and is closely associated at its cephalic end with the labium. Similar V-shaped areas are found in practically all tenthredinoid larvæ, as *Croesus, Pteranus, Lygœonematus, Abia,* and *Lophyrus.* This area is reduced to a protuberance in *Cimbex,* to a slight brownish mark in *Cephus,* and is completely wanting in *Tremex.* (Fig. 10). In larvæ containing black or fuscous markings, this area of the microthorax (Fig. 27, mc) is almost invariably so marked.

The three sub-regions of the thorax can usually be identified by the presence of thoracic legs. This is true in the Xyelidæ, Pamphiliidæ, and Tenthredinidæ. In the remaining families the thoracic legs are generally represented by short, unsegmented stubs or swellings (Fig. 10, tl). The mesothorax and metathorax are similar in form, the prothorax resembles them closely, but in many species, particularly among the Tenthredinidæ, the thorax is greater in diameter than the head, and the dorsal portion of the prothorax is declivous. Among most larvæ other than the Tenthredinoidea, it is quite characteristic for them to have a transverse plate on the dorsal aspect of the prothorax and sometimes even on the other subdivisions of the thorax, such a chitinized plate or dorsal shield is found in the Tenthredinoidea only in the family Pamphiliidæ (Fig. 1, d), where it appears to be characteristic of all the species. In some species this plate is divided into three parts. The segments of the abdomen as already indicated are quite similar in form to each other except the tenth (Figs. 1, and 27), which will be discussed more fully later.

The external openings of the respiratory system, the spiracles (Fig. 1, s), are usually distinct and frequently surrounded by a different color from the adjacent parts of the body. There is a pair of spiracles on the prothorax, located near its caudal part in *Pamphilius,* and near the middle of the segment in the Tenthredinidæ (Fig. 27). These spiracles are morphologically the mesothoracic spiracles, which have migrated from their position between the segments on to the prothorax. They

are usually the largest spiracles on the body. There is a pair of rudimentary spiracles between the mesothorax and metathorax (Fig. 1). The presence of these spiracles is of interest, they are open spiracles in the nymphs of insects with an incomplete metamorphosis so far as observed, rudimentary or wanting in the larvæ of insects with a complete metamorphosis, but large and prominent and open in many of their adults. These rudimentary spiracles have been found in all the larvæ examined, they can be identified as minute brownish spots in line with the other spiracles. The abdomen bears a pair of spiracles on segments one to eight. The spiracles on the first abdominal segment may be as large as the spiracles located on the prothorax or only half their size, they are usually larger than the spiracles on segments two to seven. The spiracles on the eighth segment are usually larger than those on segments one to seven, frequently twice as large and sometimes as large as the spiracles on the prothorax. The spiracles are usually all of the same color and frequently surrounded by a triangular black or fuscous mark as in (Fig. 6, s) *Cimbex.*

The thoracic legs (Figs. 1, and 27) are fleshy and robust at their proximal ends, slender and pointed at their distal ends. The coxa or proximal segment constitutes the largest part of the leg, not only in length but in width. In the Tenthredinidæ the coxa is divided longitudinally by a suture into two parts the edges of the suture and the proximal part of the coxa are frequently of a different color from the adjacent parts, so that the legs appear to be marked by a brownish or fuscous Y. The trochanter is a short narrow ring in the Pamphiliidæ, but is hardly indicated in the Tenthredinidæ. The femora and tibiæ are sub-equal in length to the trochanter in the Pamphiliidæ, though smaller in diameter, but in the Tenthredinidæ the femur is considerable longer than the tibia and much longer than the trochanter. The tarsus and claws of each leg are fused and but little if any longer than the tibia. The claw is hooked at apex. Many of the species which cling to the edge of the leaf with the thoracic legs, have their legs black, except at the joints.

Abdominal legs or prolegs (Fig. 27, pl) are present in the families Xyelidæ and Tenthredinidæ. They are fleshy protuberances and differ from the prolegs of lepidopterous larvae in that they lack the circlet of terminal hooks. In the Xyelidæ the prolegs are small and there is a pair on each segment. The most of the sub-families of Tenthredinidæ have prolegs present on segments two to eight and ten. In the Nematinæ, Hoplocampinæ, and Acordulercerinæ the prolegs are large and placed on segments two to seven and ten, while in the Hylotominæ they are placed on segments two to six and ten. In the Nematinæ and Hoplocampinæ the prolegs are placed along the lateral part of the ventral aspect of the segments while in the Acordulecerinæ they are minute tubercles placed close together adjacent to the meson. In *Phlebatrophia,* which is a leaf-miner, there is a pair of protuberances on each thoracic segment between the thoracic legs in line with the abdominal prolegs. In those groups where the prolegs are present, they differ from lepidopterous larvæ in that they always have a pair of prolegs on the second abdominal segment. The prolegs are generally of the same color as the ground color of the body; in some species there is a round, black spot, pad-like, on the cephalic side of each proleg. In some black larvæ, as *Pteronus ventralis,* the prolegs are white.

The prolegs of the tenth abdominal segment, the anal prolegs, are usually larger than the others, longer and broader, and comprise the greater part of the tenth segment (Fig. 27). In the larvæ of certain species of the genus *Pachynem-*

atus and *Pteronus,* the caudal third of the abdomen is narrowed and bluntly pointed, the prolegs of the tenth segment are correspondingly reduced or rudimentary.

In the Pamphiliidæ the tenth abdominal segment bears on each side a distinctly segmented appendage, an anal cercus (Fig. 1, ac). These appendages are not segmented in any other group of the superfamily and never so large. In a number of genera, though not characteristic for the genus, there is a pair of pointed projections, which have been homologized with the anal cerci (Figs. 27, and 11, ac). They are of more frequent occurrence in the Nematinæ than in any other subfamily of the Tenthredinidæ. They are also present in the cephids and in *Tremex.*

There is a distinctly chitinized dorsal plate on the tenth segment in the Pampiliidæ (Fig. 1, a10), which is wanting in all the other groups. In the boring larvæ the tenth segment bears a fleshy or chitinized mesal spine (Fig. 11). The anal opening is a transverse slit located along the dorsal part of the anal prolegs and its lips usually bear transverse rows of fine setae. In certain species where the larvæ are opaque white or green in color, the centre of the dorsal aspect of the tenth segment bears a fuscous or black spot. This is of freqnent occurrence in those larvæ that curl themselves helix-like on the underside of a leaf. The black spot is placed eye-like in the centre of the coil.

Each abdominal and thoracic segment is crossed by transverse lines. These lines are interrupted in the region of the spiracles so that the dorsal and ventral lines are not continuous. There is also generally a difference between the thoracic and abdominal segments in the number of these depressed lines. These lines divide the surface of the segments into elevated ridges. These ridges are known as annulets (Fig. 6, and 1-7). The number of annulets is constant for each species. In inflated specimens that are abnormally inflated and in specimens that are dropped directly into alcohol and shrunken, they are difficult to identify, but in living specimens and carefully prepared specimens they are easily followed and undoubtedly will prove of great service in the classification of these larvæ.

If the condition found in the Pamphiliidæ may be assumed to be the generalized condition, the primitive number of annulets would be four (Fig. 1), since the larvæ of this family have that number on both the dorsum and the venter. The ventral annulets of the Pamphiliidæ are as well marked as the dorsal, but in the groups bearing prolegs the ventral annulets are greatly reduced (Figs. 7, 8, and 12). The ventral annulets are usually difficult to identify in the Tenthredinidæ and are rarely more than three. While in some species the number of thoracic annulets is the same as the abdominal, as a rule there is a difference: in the great majority of the species the primitive number of four is retained, but in some species there may be more than four, and in others less. The usual number of annulets on the dorsum of the abdominal segments is six, as in the Emphytinæ (Fig. 12), Selandriinæ, and Lophyrinæ. This number has probably arisen from the primitive four by a subdivision of the second and third. The maximum number is found in *Cimbex* (Fig. 6), and *Trichiosoma,* where the number is seven: the minimum number is found in the Acordulecerinæ, so far as observed, where there are three. In the Pamphiliidæ, as already indicated, there are no annulets on the tenth segment and they are frequently wanting in the larvæ of the Tenthredinidæ (Fig. 27).

The annulets of the dorsal and ventral surfaces are not continuous, as already indicated, but interrupted in the region of the spiracles. In the Pamphiliidæ there is an elevated longitudinal fold extending the length of the segment just below the spiracle, which has been designated the spiracular area (Fig. 1, sa). This

area is also distinct in the Tenthredinidæ (Figs. 6-8 and 12, sa). There is also an area that is marked in certain larvæ, which is located above the spiracular area and behind the spiracle and appears to be formed from the fourth and sixth annulets. This has been designated the postspiracular area (Figs. 6-8, 12 and 27, pa). There is a third area, which is located between the base of the proleg and the spiracular area, the pedal area (p). This area varies considerably, even in the same insect; on some segments it may be a single area and on others divided into two (Fig. 27, p).

The body, comprising the thorax and the abdomen, may be either black, white, green, spotted or banded. The great majority of the larvæ are white or green. In the green larvæ the color is due in great part to the blood or the food contained in the alimentary canal. In such larvæ the dorsal vessel or heart also usually shows as a darker median band. The air tubes or tracheæ along the lateral margins of the dorsal vessel and along the lateral aspect of the body and connecting the spiracles, show as silvery or frosted lines, either one or both of these may be obscured. In a few species there is a double row of dorsal yellow spots in certain Nematinæ and a lateral row of similar spots on the postspiracular area of certain segments. These yellow spots are due to the presence of patches of yellow adipose tissue or fat, which can be seen through the transparent cuticle. Markings due to the food, the colour of the blood, the air-tubes, or the adipose tissue are serviceable in separating different species, but unfortunately they disappear wholly or in part when the larvæ are preserved in alcohol. Frequently, however, an entirely new set of colour characters appear, due to the preservative fluid.

Many species of larvæ are marked by bands or spots of varying degrees of prominence, which are due to pigmented colours. The median dorsal black line of *Cimbex* is such a color, a median black line is usual for the group and is characteristic for the genus. When pigmented dorsal bands are present, they are usually located one on each side of the dorsal vessel. There is also frequently a band on each side along the line where the dorsal and lateral aspects meet. These lines are continuous with the fuscous bands found on the vertical furrows. The bands, while appearing continuous to the unaided eye, are seen, when examined with a lens, to be a series of spots interrupted by the crossing of the furrows between the annulets. There are frequently interrupted bands on the pleural aspect formed by a series of spots on the spiracular and pedal areas (Fig. 27).

The thoracic and abdominal segments of most of the larvæ examined bear setæ (Figs. 6-8, 12, and 27). The arrangement of these setæ, as groups of setæ, not as individual setæ, is characteristic for genera at least. In the Emphytinæ, certain Selandriinæ, and Tenthredininæ, the setæ are fine and of the same colour as the body cuticle (Fig. 12), consequently inconspicuous and readily overlooked. They are arranged in transverse bands and are usually placed on the first and third annulets or the first, third, and sixth annulets. There are also longitudinal bands on the spiracular and pedal areas. In many Blennocampinæ (Fig. 8) the setæ are large and spine-like, bifurcate at apex. In some species of this subfamily the terminal bifurcate portion is wanting and they are represented by white protuberances or black spots. These larvæ during their ultimate stage, even the spiny species, have apparently naked bodies. The bifurcate spines are replaced by fine colourless setæ like those of the Emphytinæ. A different condition is found in certain Nematinæ and the Acordulecerinæ, where the setæ are fine and colourless and difficult to locate in all the stages but the ultimate, where each seta is placed on a small black or fuscous spot, completely changing the appearance of the larva and distinctly marking the location of the setæ.

In certain Nematinæ (Fig. 27) and the Hylotominæ (Fig. 7), the setæ are arranged in groups or singly on small elevated areas. The larvæ of *Pteronus ribesii* and of *Hylotoma* show the maximum type of the development of this form of maculation, where the spots bearing the setæ are arranged in transverse bands on the dorsal and lateral aspects of the annulets and in longitudinal spots on the areas adjacent to the spiracles. The number and size of these spots, which are black, give the larva a predominance of this colour. These black areas are constant in their location for a given annulet for successive segments for a given larva. This has been assumed by some writers to be the generalized type of maculation, but an examination of a series of species will show that it is an extreme type of specialization. In some nematids similar spots are found only on the thoracic segments, in others they may be limited to the dorsal aspect of the body or to the lateral aspect. The larva of *Croesus latitarsus,* which apparently has a somewhat similar type, is in reality entirely different. The individual spots in this species extend on to two or more annulets without regard to the setæ, while in *Pteronus ribesii* (Fig. 27) the setæ are all located on the spots, but in *Hylotoma* (Fig. 7) there is an abundance of setæ between the spots.

There is still another type of colouration, which is characteristic of a large number of larvæ of the Emphytinæ and Selandriinæ. These larvæ during the first two or three instars are opaque white in colour. The lateral aspects of the body in the region of the spiracles, as they age, becomes gradually infuscated. The venter, including the prolegs and a narrow band along the ventral margin of the lateral aspect, remains opaque white. This lateral infuscated band is only slightly indicated in the first stages of its appearance and in some species never gets any stronger throughout the life of the larva. But among other species all degrees of intensity occur, from a light brown to a chocolate brown and black. The median part of the dorsum is white in the infuscated species, but with the increase in intensity of the lateral bands, the dark colour suffuses over the entire dorsum and in the very dark species the pleura and dorsum are a uniform dark chocolate colour during the last instar. The larvæ which develop this type of colouration usually rest curled up on the underside of the leaf like a snail shell or helix. In the very dark coloured forms the white of the ventral surface is completely obscured, and the anal prolegs, which are white, are turned so as to be exposed and to form the apex of the helix and look like a white eye. Each seta is placed on a minute white spot; with the dark background they stand out distinctly.

The larvæ of certain Tenthredininæ have a similar type of colouration, but they differ from the Emphytinæ and Selandriinæ in that they have an ultimate stage. No matter what the colour during the preceding instars, they are immaculately glassy-green during the ultimate stage.

The Cladiinæ feed stretched out flat on the surface of the leaf. The adults have generally been assumed to be closely allied to the Nematinæ and usually associated with them. All the larvæ of this group that have been examined are entirely different in appearance from the nematids. They practically all have the same type of colouration described above for the emphytids and selandrids and during their last instars are highly coloured. Their resemblance to the Emphytinæ is enhanced by their flat body and method of feeding. They are also peculiar in having a great abundance of long setæ on the head as well as on the body segments.

In *Cimbex* and *Trichiosoma* the body is green or white, a median dorsal black line in *Cimbex*. The pleural part of the annulets and the areas adjacent to the spiracles bear a number of papilla-like elevations (Fig. 6), which are more prom-

inent in *Cimbex*. The surface of the body in addition is densely covered with minute granulations in this genus, the setæ appear to be wanting on the dorsal aspect and are few and fine on the pleural aspect while in *Trichiosoma,* although they are small, they follow the ordinary arrangement described for the Emphytinæ. None of the large granulations bear setæ.

Several subfamilies of Tenthredinidæ have glands on the thorax or abdomen which open on the external surface of the body. These glands excrete a fluid which is used either for effecting the food plant or for protection.

The most striking of the protective glands are peculiar to the Cimbicinæ (Fig. 6, pg.). If the spiracles of abdominal segments two to eight are examined, a small round opening will be noted just above them. A watery fluid is poured from these openings; it is this fluid that makes the body of the larva wet when it is taken in the fingers. The larvæ are also able to throw this fluid in a jet for a distance of a foot or more; they feed exposed; rest curled up into a ring on the upper surface of the leaf. The ability to wet their bodies and to throw out this fluid in jets is undoubtedly a protection to them.

All the larvæ of the genus *Caliroa* so far as examined have a pair of long, finger-like glands attached to the prothorax between the head and the prothoracic legs (Fig. 26 ph). They are longer and larger than the legs, so that in preserved specimens the larvæ look as if they had four pairs of thoracic legs. These larvæ are leaf skeletonizers, feeding on the under surface. They feed with these glands folded around the front of the head, much as one would fold their arms across their face. The ventral part of the head is completely concealed, and if a feeding larva is examined with a lens, it will be seen that the glands and mouth-parts are enveloped in a gelatinous substance like thin cherry-gum. This substance evidently influences in some way the surface of the leaf on which the insect is feeding. The glands are wanting in *Endelomyia* and, if present in *Phlebatrophia,* are not exserted at all times as in *Caliroa.*

In the larvæ of the Cladiinæ, Hoplocampinæ, and Nematinæ, there is on the ventral aspect of abdominal segments one to seven a single gland located on the meson. The mouths of these glands are located between and slightly behind the prolegs (Fig. 22). The transverse slit marking the position of the mouth is elevated and is readily identified in preserved specimens even if the glands are not extruded. The glands are retracted sacks like the osmateria of certain butterfly larvæ and are usually extruded when the larvæ are killed in hot water (Figs. 20-21). The extruded glands vary greatly in form from short ovate knobs to long club-shaped structures three or four times as long as broad. They are heart-shaped in *Lygaeonematus* (Fig. 23), and club-shaped in *Croesus* (Fig. 21). It has already been noted that the larvæ of the Cladiinæ rest flat on the surface of the leaf, likewise certain Hoplocampinæ, and a few Nematinæ. All the other larvæ of the Hoplocampinæ and Nematinæ are edge feeders. They grasp the edge of the leaf with the thoracic legs and rest with the abdomen stretched along its edge or slightly to one side, but ordinarily not clasping the edge of the leaf with the prolegs, or with the abdomen elevated and bent in the form of a letter S. If the food plant is jarred, the abdomen is thrown over until the dorsal surface of the abdomen either rests upon or is close to the dorsal surface of the thorax. The placing of the abdomen in this position brings the mouths of the ventral glands to the exterior and to the point where attack would be expected. If an ichneumon approaches such larvæ, the abdomen is waved back and forth through the air. The action

of the larva in bringing the glands into prominence would suggest that a fluid or disagreeable odour was poured out from them. Although larvæ representing several species and genera were examined, no fluid or fetid odour was noted. It may, however, be a fetid odour perceptible only to insects.

The larvæ collected on sedge and believed to belong to the Dolerinæ have on abdominal segments one to seven a pair of deep oblique folds. These folds are located on the segments in line with and behind the prolegs. There has been no opportunity to study sections of these structures, and the mouths of the folds do not appear like the mouths of glands. It has been assumed that they were glands from the general occurrence along these folds of plate-like masses, which are striated, grayish in colour, and project downward for a considerable distance, and have all the characteristics of a glandular secretion.

After so full a discussion of the metamorphosis, anatomy and coloration of the larvæ, a word should probably be said in conclusion as to their classification. The larvæ are divisible into four types. The first three families, Xyelidæ, Pamphiliidæ, and Tenthredinidæ, represent three of these types. They have distinct thoracic legs, which would suggest some relationship. The two generalized families, Xyelidæ and Pamphiliidæ, are clearly the most primitive in their larval as well as in their adult characters, and like the adults would suggest that they have arisen along different lines. The Pamphiliidæ with distinctly segmented and long antennæ and segmented anal cerci are the more primitive so far as their larval structures are concerned. The lack of prolegs is difficult to explain. The Xyelidæ with inconspicuous antennæ and without segmented anal cerci are readily differentiated from the Pamphiliidæ, while the presence of prolegs on each abdominal segment would suggest a generalized condition entirely different from that found in the Pamphiliidæ. From the structure of their wings the Xyelidæ are unquestionably the most generalized, but from the structure of their larvæ the Pamphiliidæ are unquestionably the most generalized. The Tenthredinidæ suggest a stage of specialization from the Xyelidæ. They have a similar type of antenna, with a reduction in the number of prolegs. The general similarity of the habitus of the larvæ of the various subfamilies would suggest, like an examination of their wings, that they represented a single homogeneous group instead of several of higher rank. The Xiphydriidæ, Siricidæ, Cephidæ, and Oryssidæ are correlated together as adults, they should likewise be associated from larval characters. The most striking is the loss or reduction of the thoracic legs, the lack of prolegs, and the presence of a caudal cuticular horn. The antenna of *Cephus* is similar to that of the Nematinæ. Not enough is known regarding the larvæ of these later groups to offer anything as to the interrelation of the families.

List of Abbreviations.

a 1-10..Abdominal segments one to ten.
ac.....Anal cercus.
an.....Annulets.
ap.....Antecoxal piece of the mandible.
apl....Anal proleg.
at.....Antenna.
as.....Antennal socket.
au.....Anus.
c.....Clypeal suture.
cl.....First clypeus.
c2.....Second clypeus.
ch.....Caudal horn.
cr.....Cardo.
d.....Dorsal shield.
e.....Epicranial suture.
f.....Front.
fc.....Fronto-clypeal suture.
g.....Gena.
gd.....Gland.
gl.....Galea.
l.....Labrum.
la.....Labial palpus.
lb.....Labium.
lg.....Ligula.
m.....Mandible.
mc....Microthorax.
me....Mentum.
mg...Mouth of gland.
mx....Maxillary palpus.
o.....Ocellus.
oc.....Occiput.
of.....Occipital foramen.
ol.....Ocularum.
p.....Pedal area.
pa.....Postspiracular area.
pf.....Palpifer.
pg.....Pleural gland.
ph.....Prothoracic gland.
pl.....Proleg.
ps.....Prothoracic spiracle.
pt.....Postgena.
s.....Spiracle.
sa.....Spiracular area.
sb.....Submentum.
sp.....Spinneret.
st.....Stipes.
t1-3....Thoracic segments one to three.
ta.....Anterior arm of the tentorium.
td.....Dorsal arm of the tentorium.
tl.....Thoracic leg.
tp.....Posterior arm of the tentorium.
tn.....Tentorium.
tr.....Trochantin of the mandible.
v.....Vertex.
vf.....Vertical furrow.
vg.....Ventral gland.

Explanation of Plate I.

1. *Pamphilius dentatus.* Lateral view of entire larva.
2. *Pamphilius dentatus.* Cephalic aspect of head.
3. *Cimbex americana.* Cephalic aspect of head.
4. *Pamphilius dentatus.* Caudal aspect of head.
5. *Cimbex americana.* Caudal aspect of head.
6. *Cimbex americana.* Lateral view of third abdominal segment.
7. *Hylotoma* sp. Lateral view of third abdominal segment.
8. *Periclista* sp. Lateral view of third abdominal segment.
9. *Pamphilius dentatus.* Ventral view of head.
10. *Tremex columba.* Head and prothorax.
11. *Tremex columba.* Abdominal segments nine and ten.
12. *Macremphytus varians.* Lateral view of third abdominal segment.
13. *Pamphilius dentatus.* Maxillae and labium.
14. *Trichiosoma triangulum.* Antenna.
15. *Hylotoma* sp. Antenna.
16. *Caliroa limacina.* Antenna.
17. *Cephus pygmaeus.* Antenna.
18. *Pristiphora bivittata.* Antenna.
19. *Lophyrus* sp. Antenna.
20. *Croesus latitarsus.* Ventral view, showing extruded ventral gland.
21. *Croesus latitarsus.* Laternal view of ventral gland, enlarged.
22. *Croesus latitarsus.* Ventral view, showing mouth of ventral gland.
23. *Lygaeonematus erichsonii.* Lateral view of ventral gland and proleg, enlarged.
24. *Lygaeonematus erichsonii.* Ventral view, showing extruded ventral gland.
25. *Macremphytus varians.* Ventral view of an abdominal segment where gland is wanting.
26. *Caliroa limacina.* Ventral view of head and thorax, showing prothoracic glands.
27. *Pteronus ribesii.* Lateral view of entire larva.

ADAPTATION IN THE GALL MIDGES.

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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 their 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 defence.

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 would be assigned sufficiently exact values so 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.

4. 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 pædo-

genesis, an adaptation of inestimable value to species living under such conditions and dependent upon weakly organized adults for their establishment in favorable 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

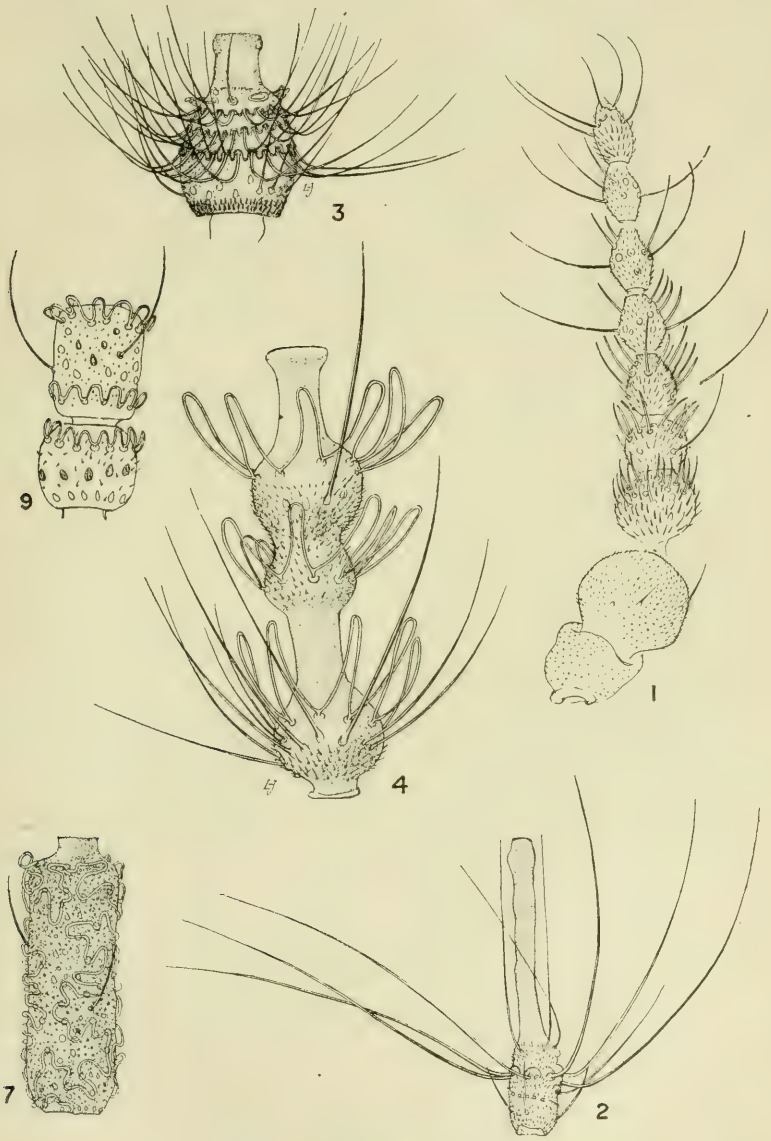

Fig. 3.—Gall Midge Structures.

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 men-

tioned 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 favorable adaptation to existing conditions.

Midge Galls.—Recalling the fact that the more ancient type of gall midges appear to be related to the fungus gnats or Mycetophilidæ, and that they furthermore exhibit similar preference 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 variously 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 these 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 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 a favorable 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 loose bud galls simply by the fact that in the roll only a portion of the leaf is involved, while in the bud gall all or 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 multiocular, 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 Crataegus. The globular or lobulate galls of *Cincticornia globosa* 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.

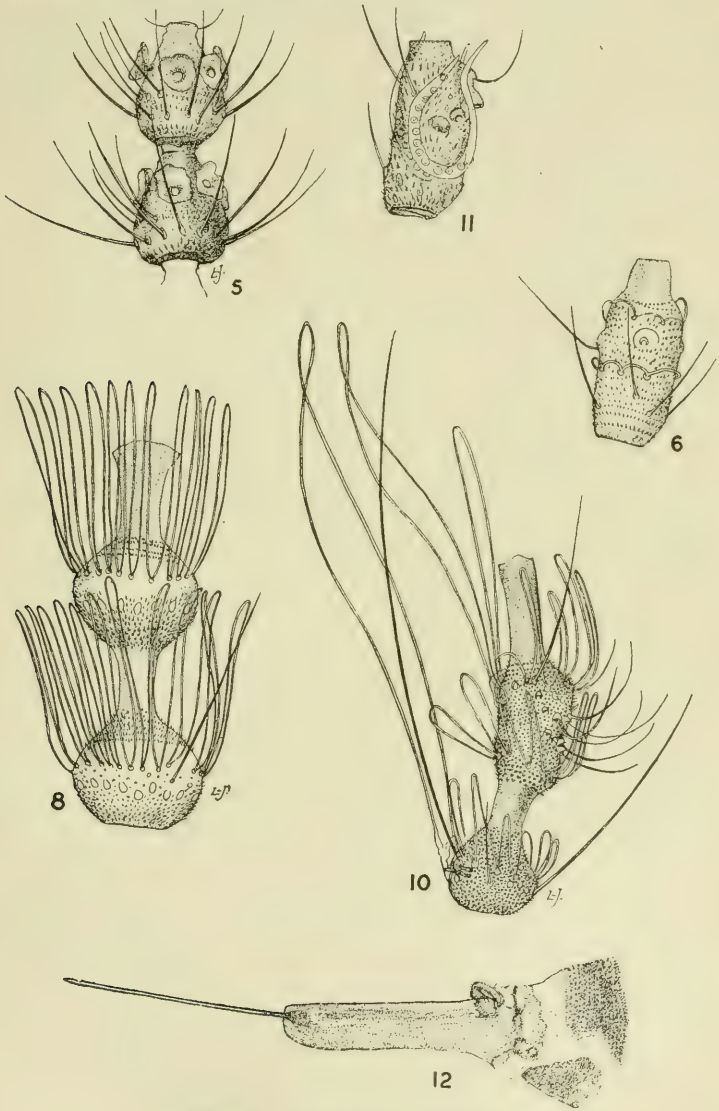

Fig. 4.—Gall Midge Structures.

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 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 of 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 spider.

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 speaker elsewhere and need not be dealt upon at the present time.

5. 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 striking 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 eight segments in Tritozyga and Microcerata to the rather highly specialized organs with as many as 33 segments in *Lasioptera querciperda.* There is an equally great variation in the form of the antennal segments and their sensory organs. The cylindric antennal segment is undoubtedly the more generalized type, and 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 Itonididinariæ we have a dumb-bell-shaped structure, the basal and 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 by the presence of peculiar, colorless, threadlike, homogeneous, chitinous structures which we have named circumfili because they invariably run round 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 hetæ, suggest our latest means of communication, the much vaunted "wireless," and present distinct analogies thereto. Both respond to impulses conveyed through the 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 of 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 favorable 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 Figs. 3 and 4.

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 diervillae*, 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 trinondose structure of the segment and the peculiar circumfili or bow whorls.

5. Seventh and eighth 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 occurring in the female Itonididinariae.

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 caryae*, 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, the three circumfili, and particularly the greatly produced loops and setae 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 reversible basal portion of the ovipositor and the highly developed needle-like terminal part.

CHRYSOMELIANS OF ONTARIO.

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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, preferably 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. He was 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 Beetles till I caught them on my side of the farmer's fence, the one feeding on the Bittersweet and the others on 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 would 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 alien a point of view as this about the Chrysomelidae 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 its 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 honored President's old home of Trinity College School, and in order thoroughly to enjoy the day 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 all 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, 5 miles up the track. I am giving myself as well as you a treat, for this is a favorite 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 amount and Ontario about 1-70th. But even Ontario's share, nearly 300 species, makes a long list, the 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 least 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 Le Conte and Horn or in Blatchley as there are in Professor Wickham's papers on the Chrysomelidae 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 Johnson 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 twelve 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 Cerambycidae, 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., three-quarters 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 forty 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 destructive 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 such as the 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 will 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 oak-fern 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 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 Haemonia has only one species, but the Donacia (Reed beetle, as the Greek name implies) has more than twenty 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 root or stems of the food-plant beneath the surface. The beetle is covered on the under side with a pubescence that acts as a perfect protection, 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, and alighting 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 antennae 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 twenty 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 zig-zag 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 antennae, I should judge it a species of Adela. We have but one species of *Orsodacna* and I have always found it on hawthorn, twice in great numbers, once here and once at 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 extend 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 colored 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 color 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 sixteen 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 fourth Tribe known to me; for though North America has seven genera in the tribe and over twenty 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 these raspberries one day 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 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 fastening 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 fifth 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.

On these same raspberry leaves is often found a small yellow beetle with a black thorax ornamented by two white spots; it frequents many other leaves besides such as basswood and hazel, but it is most abundant on raspberry. It is *Bassareus luteipennis,* the first of seven genera that constitute Tribe VI. These seven genera contain over 100 species, about fifty being found in Ontario. Three of the genera, containing over 35 species are represented right in this wood. Bassareus on the raspberry, *Cryptocephalus quadrimaculatus* (the size of the insect as usual in inverse proportion to its same) on the young shoots of white pine where the needles are soft, and *Pachybrachys* on the willow shrubs at the lower end of the wood. The members of this tribe are small, sometimes minute and stoutly cylindrical in shape, what we would call "chunky"—indeed Pachybrachys (the Greek for "thick-short") is only a grand name for "chunky." Some of the species of Crytocephalus (which means "hidden head") are very pretty, especially *venustus* which I have found on the blossom of the meadow-daisy, and *mutabilis* taken on birch and spiraea.

As we walk back to the road that we left at Mose Robinson's we can collect no less than five genera of the next or seventh Tribe. In the hollow at the north-east of the wood where the clump of willow and dogwood grows, you will find *Xanthonia* on the leaves of the former and *Adoxus* on those of the latter; the first a small and the second a medium-sized beetle, closely resembling each other in shape and general color; about the trunk and limbs of that newly felled pine on the bank, *Glyptoscelis,* a fairly large beetle, metallic brown in color but looking lighter from its pubescence; on the common Dogbane (*Apocynum androsaemifolium*) you will find *Chrysochus aureus,* a large dazzlingly brilliant bluish-green beetle; it is said to feed on Indian hemp (*Apocynum cannabinum*) and on Milkweed (*Asclepias*), but I have never found it on any milkweed or on any other species of Dogbane than the common, sweet-scented species with pinkish blossoms; *Apocynum cannabinum* has greenish-white blossoms and no scent; as the Dogbane is filled with a white milky juice just as abundant as that of the Milkweed, Blatchley's description may be erroneus; on the Dogwood, again, both leaves and blossom, a fifth genus of this tribe (*Colaspis*) is often found.

Returning to the road just east of Robinson's we face east. South of us lie two upland meadows of rough grass, somewhat rocky and covered with hummocks and watery hollows, a favorite place for the kill-deer plover; here too sometimes in the fall is heard the peculiar cry of the Yellowlegs. As I was walking along here at the end of last April, I heard a strange bird-note; a long, loud whistle, melodious and with something of the plover's plaintiveness about it. After some time I discovered a bird with long narrow wings circling at some height over the meadows, and several times the strange cry was repeated. I brought a friend out with me next week and with the aid of field glasses we watched as many as three pairs of the birds feeding, running and flying about these meadows. On alighting they would raise their wings over their backs till the tips met and then slowly fold them down at the sides, at the same time uttering this long drawn whistle. The bird I had first heard, however, was certainly calling as it hovered and circled high over the field, and as I stood under it I distinctly saw its neck and wings grow rigid for a moment as it forced the cry out on to the air; it was the Bartramian Sand-piper, and this was its mating call. I had the luck to startle a hen bird off her nest of eggs early in May quite near the fence that we are going along. Once the eggs are laid the birds become very shy and can rarely be approached. But in the mating season they seem fairly tame, and we watched one settle twice on the top of a fence post just north of where we are now, within stone's throw of a farm-house. I was standing in the roadway at the time, and my friend was at the snake-fence, his foot on the bottom rail and his field glasses resting on the top, when I noticed a weasel running along the bottom rail in our direction; it showed not the slightest fear and never hesitated, but advancing steadily, stepped right over my friend's foot; in its teeth it held by the nape of the neck, limp and lifeless, a large field-mouse, doubtless the family dinner. These creatures are very bold and show the utmost unconcern of human beings. I remember being stopped some years ago by a section boss on the railway who asked to show me a nest under a culvert that his gang had been cleaning out; "There," he said, disclosing four little blind nestlings, "What's them"? "Why," I said. "they look like weasels." "That's what they are, I reckon," came the answer, "and the mother fought like a good one for nearly an hour to get back to them: we had to drive her off with stones before we could get at work on the culvert."

Along this stretch of road, within the space of a few rods, we shall find no less than five genera belonging to the eighth Tribe on our list. Under chips of wood by the roadside in the early spring, I have frequently found a small beetle, variegated black with yellow-brown stripes, called *Prasocuris;* on the common milkweed the large handsomely marked orange and black *Doryphora clivicollis* and on the bittersweet growing over that stone-pile, its cousin *Doryphora decemlineata,* that ubiquitous pest, the Colorado potato-beetle; in the blossom of the dogwood, a small metallic dark-green beetle that feeds also on elm leaves, *Plagiodera viridis;* about the knotweed at the wood's margin, the pretty little *Gastroidea polygoni* with yellow-brown thorax and peacock-green elytra; while in the grass a little further on I took two specimens of *Lina scripta* as early as the end of April; no doubt hibernated specimens, probably from the willow clump nearby, for that is a favorite food plant of the *Lina scripta;* it is a somewhat variable species, of which I have found two quite distinct forms on the willow, one the normal form at Guelph and the other near Lindsay. There still remains in this tribe a genus that I have so far left unmentioned, the most beautiful of all the family and well worthy of the high compliment (*pace* the economic entomologist) paid it by

naturalists,—*Chrysomela* (Golden Apple—or is it an Homeric word meaning "golden sheep"?) from which the tribe gets its name of Chrysomelini or Chrysomela-like beetles, and the whole family its name of Chrysomelidae, the scions or clan of Chrysomela. This is a most beautiful beetle; the characteristic appearance being roundish-oval in shape and decidedly convex above; head and thorax mostly dark metallic and wing-covers a creamy white, daintily sculptured with metallic greenish or bluish black. It suggests old ivory inlaid with ebony or jet. In the early days of collecting, this was a beetle I coveted more than any other; the species that above all took my fancy being *Chrysomela scalaris.* There was a brother-collector in town whose cases I was continually poring over. But it was in my second season as a collector that I first had the luck to "strike ile," and it was right on that dogwood bush behind the north fence of our road. I found here several specimens of a Chrysomela rather smaller than *scalaris* with greenish-black head and thorax, elytra cream-coloured and finely sculptured and dotted with metallic greenish black; it proved to be *Chrysomela philadelphica,* and a short search among dogwood shrubs yielded me some 50 specimens of the beetle. This was at the end of June and in July I migrated with all my bug-and-weed paraphernalia to the Rideau Lakes. It wasn't long before I found grazing on basswood leaves along with walking-stick insects, whole flocks of a small whitish larva, marked with black, somewhat louse-shaped, and so strongly resembling the larva of the Potato-beetle that visions of *Chrysomela scalaris* began again to float before my excited imagination and to haunt my dreams. I separated about fifteen of the best grown lambs of the flock and shepherded them home to a domestic fold. But they seemed to scorn captivity and quite obviously pined in their cardboard box. Twice a day I brought them fresh fodder from their native pasture, but they wouldn't browse worth a cent; and I lost one or two with every moult; less than half a dozen reached maturity and of these two died in pupating. However, three emerged safely and proved the realization of my dream, *Chrysomela scalaris,* all the more lovely in being home-grown.

The knowledge that hundreds of these creatures must have matured about the basswood trees where I had made my captures drew me out to their feeding-grounds again. This time I searched in vain, not a larva could I see on any of the leaves, still less a mature insect; for the full-fed larva in this genus drops to the ground in order to pupate, and though it was the beetle itself that I had found gregarious on the dogwood, there seemed to be no such luck in the case of this species; at the end of two hours I was still empty-handed. It was when I was passing across a stubble-field in the open from one part of the edge of the wood to another that I felt something crawling on the back of my neck. Of course, gentlemen, you all know the extraordinary phenomenon of an insect crawling on the back of the neck. No matter how rare it may have been when it first settled, if once you reach with your hand to make a capture it nearly always—well if you wish for an exact figure, in ninety-nine cases out of a hundred it turns into an aculeate hymenopteron and poniards the cord of your neck with that most venomous of stilettos, the wasp-sting; in the hundredth case of course, it simply flies away. I was on the horns of a dilemma: if that creature was *Chrysomela scalaris* I wanted it badly; on the other hand I stood good chances of being stung, literally or figuratively, by its proving a wasp or something worthless or making its escape. My embarrassment was worse than that of the cockney sportsman (as pictured by *Punch*) when the bird he was aiming at suddenly settled on the middle of his gun-barrel; because, though I am told this would make a very difficult shot,

at least the man knew what he was trying to bag. There were big risks, it was a daring shot, but I took it and grabbed the insect as it was pushing down behind the collar of my negligé. An awful moment, while I waited for telegraphic communication from my neck to my inner consciousness of the sensation of five inches of hatpin jabbed viciously in to the quick and centre of one's being, that matter-of-fact people call a wasp-sting; but there was no telegram, this was the hundredth chance, and sure enough, when I came to look at my capture, it was what I had been looking for—*Chrysomela scalaris.* Where had it come from? I am certain there was none on the basswood; it had simply dropped out of pure cussedness on to my head, I presume from the sky. Next season I found three more species, one on willows very like *Chr. philadelphica* of the dogwood, but with the front and sides of the thorax margined with cream; I have taken a great many specimens of this beetle in various places, always on the willow; it is *Chr. bigsbyana.* The second new species was a smaller member of the genus called *Chr. elegans,* first found early in the season crawling on railway ties, which are not its food-plant, but afterwards found feeding in abundance on water smart-weed about the surface of a stream a couple of miles south-east of here.

There is another species of small size closely resembling this, called *Chr. suturalis.* I have never discovered the food plant to which this beetle resorts about Port Hope, but I have twice found a stray specimen on grass-blades. One year in August when I returned from my holidays, I was looking over my friend's collection of Chrysomelas, mentally checking off their food-plants as my eye roved from species to species; basswood, dogwood, willow, water smartweed and so on, when suddenly, my attention was arrested by a whole row of fine specimens of this beetle. "Hullo," I exclaimed, "where did you get these?" "Oh, on the beach, just a few days ago." In an instant I had registered a silent vow, and next morning hastened off to fulfil it in our old stand-by, the North Wood, equipped for the sacrifice with some sandwiches and a cyanide bottle. All the morning I searched beech trees diligently, without success, and all the afternoon the same, and at last went home, weary and footsore, having got nothing but aching eyes and a stiff neck. In the evening I was around again at my friend's collection. "Are you sure that you got those beetles on the beech?" I asked. "Oh, yes, and they were in fine condition: in fact one of them was still alive. I guess a thunderstorm the day before had blown them out over the lake: when I went down the south-east wind was washing them up on the beach." My beech with an "e," was his beach with an "a": he had taken his specimens on the lake shore. Disappointments like these are bound to occur; I have spent days in search among spiraea and hazels which the collectors say are the invariable food of certain species and so far the result has been an absolute blank.

We will move east about a mile, past Davison's old chair-factory on the Rice Lake Road, up hill, down dale, and up hill again as far as Bethel. Here we turn south down a grass lane to a wood of pine, oak and maple, and skirt along the edge of this wood, keeping close to the fence. Notice that sandy knoll in the wood, just west of us, with a large burrow at the top: I was approaching this one day from the south, gathering morsels as I went, when I felt that curious sense of being watched that we sometimes have. Looking up I saw what I took to be a young collie dog, reddish-brown, sharp-faced, staring straight at me: as soon as it saw me look at it, it made a movement that is very characteristic of the collie, dropped flat on the ground, its head couched between the outstretched fore-paws and so lay,

alert and watchful; I took a pace or two forward, when suddenly it did what no collie ever did, dived headlong into a sand-burrow and disappeared; it was a puppy to be sure, about half-grown—a young red fox.

A quarter of an hour s walk south-east brings us to our favorite lunching-ground, a huge pine tree surrounded by glacial boulders right at the top of a steep slope facing south; for we are on a table-land here, some 300 feet above Lake Ontario, with a magnificent view, east, west and south. This is probably the old shore line of Lake Ontario. Indeed a few miles west there are clear traces of an old beach five or six miles north of the Lake's present boundary. The top of this hypothetical cliff overlooking an ancient Lake Ontario is clearly marked east and west by its fringe of white pine. East of us there must have been a magnificent bay, for the edge of the table-land recedes in a sharp curve for nearly a mile north, and then comes forward again with a sinuous sweep to the east. Out of the two corners of this bay now proceed south-west and south-east two little trout streams whose union half-way down the sloping valley results in Gage's Creek, a stream that meanders along through five or six miles of level farm land and at last reaches the lake just east of Trinity College School.

After lunch we descend the slope to a rough meadow at the foot, on the edge of a tamarack swamp. Here we can examine some genera of the ninth Tribe of Chrysomelians; on the golden-rod which earlier in the year was badly eaten by the larva of *Trirhabda canadensis*, we see the mature insect; a large soft-winged beetle of a yellowish colour with a black or dark grey line on the outside of its wing-covers and a sutural stripe of the same down the centre of the back. Later in the year you will find two species of *Diabrotica*, commonly known as the spotted and the striped kind respectively of Squash beetle, their favorite food (especially in the larval state) being cucumber and melon vines. A third genus of this tribe I got two specimens of, on the edge of the swamp south of this meadow, but I only once have found it abundant and that was in the Algonquin Park, in a marshy bay at the shore of Cache Lake; it is said to be rare and Blatchley states its food-plant to be Arrow Arum (*Peltandra*); I found hundreds of it, feeding on a small species of the Skull Cap or *Scutellaria*; it is oblong, soft--winged, light yellow-brown in colour, with two black patches on each wing-cover,—a small one at the base and a large one near the apex; its name is *Phyllobrotica discoidea*. One more genus is represented here,—*Galerucella decora*, on the willow, and *luteola* on elm shoots at the west end of the meadow; a third species, *nymphaea*, is found on lily-pads; some species are quite a pest, appearing in immense numbers and destroying a great deal of foliage.

We will now walk west along the north end of Holdsworth's farm to the road that runs south between Holdsworth's and a farm of John Hume, the Port Hope seedsman. After crossing the road we come to a little brook. On the water smartweed that grows in this stream I found, three or four years ago, quite a number of medium sized black and light-brown striped beetles that worked a new trick on me in methods of escape and with considerable success. I was used to beetles that took to flight suddenly and also to beetles that dropped from their perch on leaf or plant into the tangle of vegetation below, but except for the small flea-beetles of grapevine, alder, turnip, horseradish and so on I was not prepared for jumpers. But this whole tenth Tribe consists of jumping-beetles and their hind-thighs are greatly thickened in consequence. Their name Halticini is taken from the genus *Haltica* or Flea-beetle; the name simply means "the jumper." This beetle of the water smartweed, is *Disonycha pennsylvanica*; a much larger beetle of the same

genus I have often found on willow bushes by the railway near Carmel, twelve miles north of Port Hope, and also at several points in the Algonquin Park. It is light yellow-brown with a black margin round each wing-cover and a black stripe down the middle of the same; thighs and abdomen orange-coloured; it is *Disonycha caroliniana* and a most active leaper. There is one more genus of these leapers that I have found, said to be uncommon in Ontario; it is a very pretty beetle of fair size, with a close superficial resemblance (in size, shape and colour) to *Chrysomela lunata;* reddish brown all over, this color, on the elytra, being broken into irregular stripes by narrow wavy lines of yellow. I have found it abundant on the north shore of the Upper Rideau, feeding always on the Fragrant or Canada Sumach. Blatchley describes it as "common on the sumach," but I have never found it on the poison-ivy or the stag-horn, only on the Canada sumach, which is a small shrub about the size of a gooseberry bush, having leaves almost identical with those of the poison-ivy, i.e., divided into three leaflets and slightly toothed on one or both margins; the bark and wood are fragrant, but with a certain pungency, not altogether pleasant. I shall never forget the time and the place that I first found this beetle, *Blepharida rhois;* for I got that day several treasures—this new beetle, a new fern (the ebony spleenwort) the rock selaginella, a new tree (the red cedar) and a new shrub (the Canada Sumach).

We are now on our way home. First we strike south-west for a couple of miles, through fields and woods: just before we reach the Sowden farm, we pass through some stumps of basswood, round whose base a sheaf of leafy twigs has sprouted. On these leaves I have found a smallish wedge-shaped beetle, reddish-brown in color, with some small, darker marks on it; its surface is peculiarly striated lengthwise by alternate furrows and ridges. It is called *Odontota rubra*, a leaf miner, feeding between the upper and the under surfaces of leaves and often in the larval stage very abundant on bass wood; it is the only representative of the eleventh tribe known to me.

At the Sowden farm we turn west on the old York coach road from Toronto to Kingston and pass presently through Dale or Bletcher's Corners. Arrived at the railway track we go south along it to the iron bridge over the Ganaraska at the head of Corbett's pond. Just before we cross you will notice on the steep embankment to our right hand a great growth of wild convolvulus or Morning Glory. It was here that I first found the *Coptocycla aurichalcea,* a little tortoise beetle of most marvellous brilliance: it looks, when seen alive on its food-plant, like a dew-drop sparkling in the sunshine and equally iridescent, but this dazzling lustre fades after death to a red gold. It was on the south shore of the lower Rideau that I first met this last tribe of the Chrysomelidae, the Tortoise-beetles. Feeding together on wild convolvulus, meadow-rue and one or two other plants by the margin of the lake, I found two sorts of beetle, one large and the other small. There were larvæ as well as beetles of both kinds on the same plant and often on the same leaf. They proved to be *Coptocycla guttata*, a less brilliant beetle than *aurichalcea,* and *Chelymorpha argus*. I took some larvæ and pupæ as well as imagoes home with me and watched them mature. These insects have devised a most extraordinary means of protecting themselves. From the end of the larva's abdomen protrudes what naturalists are pleased to call a forked process: on this miniature rack the creature's moults are spread and converted into a sort of tarpaulin by liquid excretions; this is then retroverted and dangles over the creature's back like an umbrella. I wonder if any of you ever came across an old book called the "Voyage and Travels of Sir John Mandeville"; this mediaeval

De Rougemont, borrowing some of his choicest traveller's tales from Herodotus, Pliny and others, describes a one-legged race of men in Africa who go so fast that (as the author justly observes) it is marvellous. As disuse leads to atrophy, much use produces hypertrophy, and Mandeville declares these one-legged men have developed such enormous feet that in the heat of the day they sit on the sand and hold their foot as a parasol over the head. In my edition of the work there is a woodcut illustrating this description, in which a native is seated on his one haunch (how to balance oneself must be as great a problem with that race as Columbus tackled in the hen's egg), shading himself from the sun with his foot over his head.

Some naturalists think that these larvæ are seeking protection from the sun in spreading this forked process over their back. But it seems more likely that they do it to escape detection by some bird-foe for whom they would be a dainty morsel. What makes me think so is that the pupa, too, is protected in a curious way. The full-grown larva pupates attached by some silk thread to the leaf, more or less exposed and helpless, but as soon as the pupa forms almost its entire surface turns greyish or bluish white; it looks like a creature that has died and been attacked by a fungus growth of mildew. It so deceived me that I was on the point of throwing specimens away. It was only when I took one between finger and thumb and felt it writhe firmly under my touch that I realized the deception. Doubtless one more case of protective mimicry.

Now, gentlemen, we are nearly home. We skirt the side of Corbett's Pond, where in May you will sometimes find on the mud flats seven or eight species of plover and sandpiper at a time, and passing along Hope Street turn up a lane near the C. N. R. bridge at Ontario Street. This takes us to De Blaquière Street, and one block brings us to the plantation of young trees sent from Guelph to Trinity College School a few years ago. Here we cross the cricket ground and gain the school, my home for more than twelve years. We have been out all day, and walked some fifteen miles, and I seem to have done a great deal of talking. I only hope I have not wearied you.

APPLIED ENTOMOLOGY FOR THE FARMER.

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 never to have become popular.

The spread of the so-called Colorado potato beetle over the country from the west eastward brought the use of 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 husbandmen, 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 of 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 afterwards, 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 position 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 science and practice 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 twenty-five 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 and 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 them 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 lifetime 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 investigation 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 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 combating insect pests, even though his acreage may be many times theirs and his crops radically different in nature.

INSECT GALLS.

By A. Cosens, Ph.D., 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 concerning 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 subjects 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'

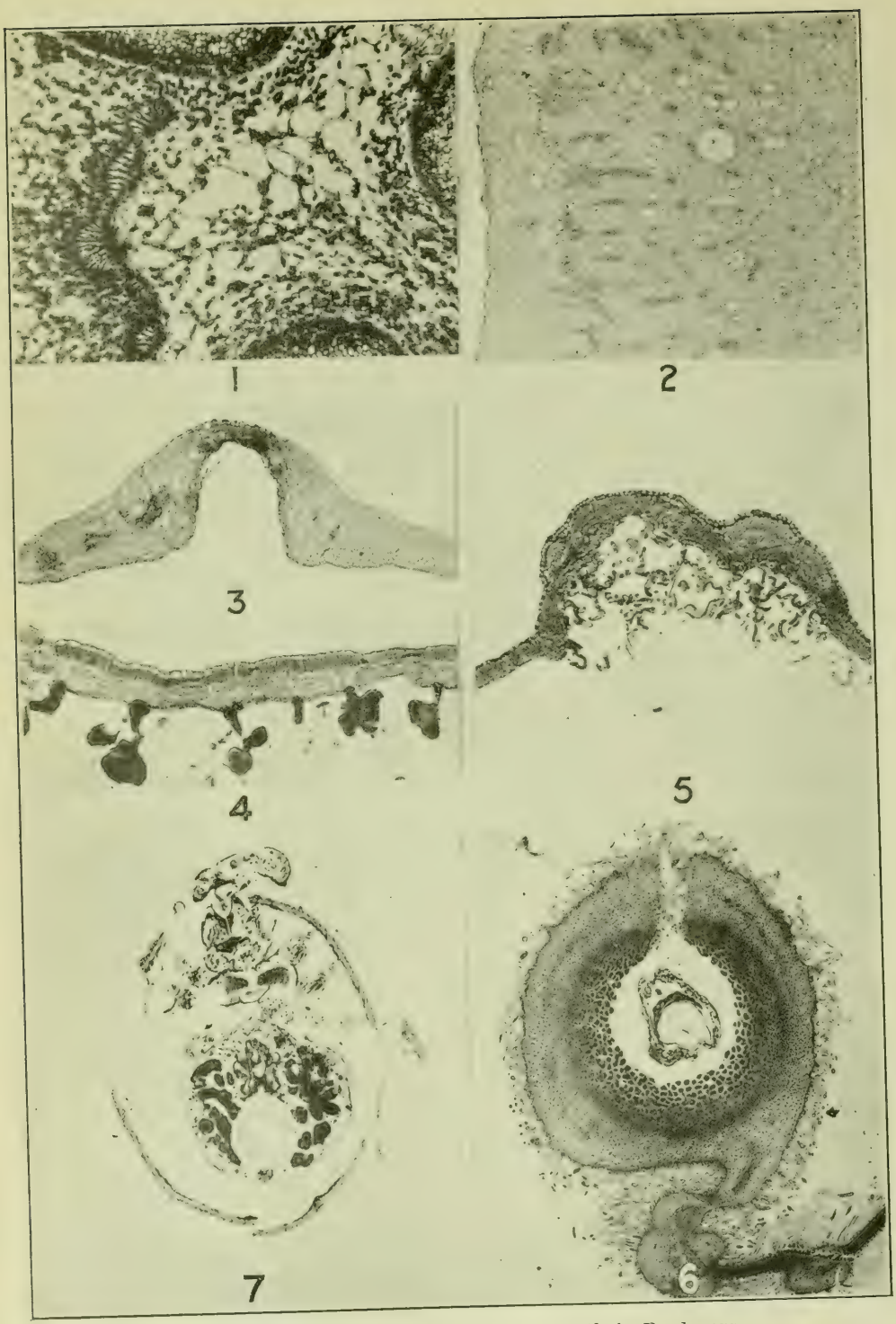

PLATE 2.—Structures of Insect Galls and their Producers.

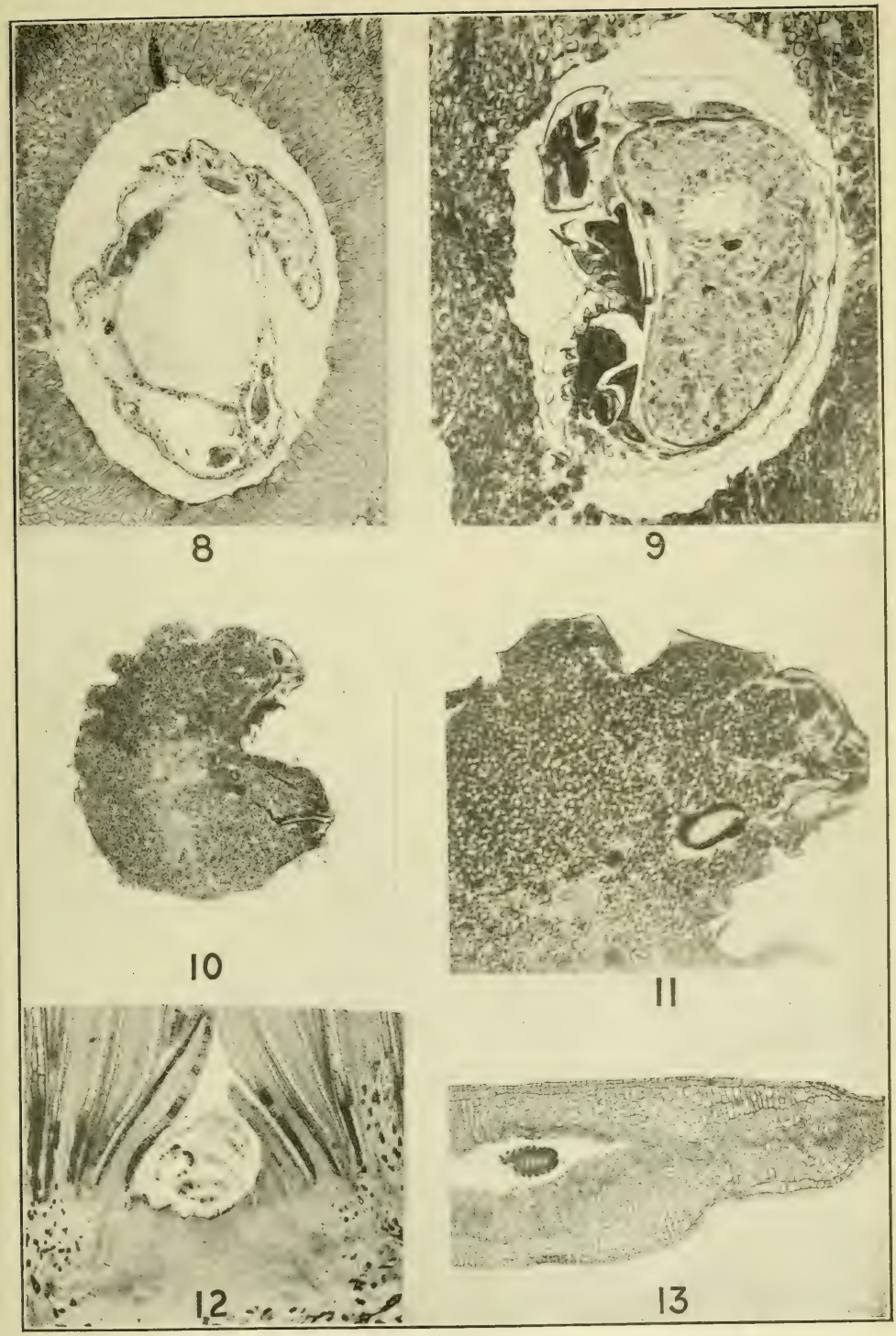

PLATE 3.—Structures of Insect Galls and their Producers.

PLATE 4.—SPONGY OAK APPLE.

(*Amphibolips confluens*, Harris.)

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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 as on plate 2, Figs. 4 and 5. 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 (Fig. 3), 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. These layers can be seen in Fig. 13. The Cynipid galls, by way of contrast, have invariably three distinct zones of tissue, 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 (Fig. 8). 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. The 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 (Fig. 2), *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 almost 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. (Fig. 5), 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 substantiates 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 part 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* Muhl. by *Rhabdophaga triticoides* Walsh, shows this tissue surrounding each larval cell. It is present in the abnormal stem and extends entirely across the pith, as can be seen in Fig. 1. 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 exceeedingly 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 families 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. This fact is exemplified in Fig. 13.

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, secretes an enzyme capable of changing

*Transactions of the Canadian Institute, Vol. IX, 1912.

starch to sugar, and has also demonstrated the presence of salivary glands opening externally in *Philonix nigra* Gillette (Fig. 11), 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.

The fact that excrement is not found in Cynipid galls has formerly been explained by the assumption that the alimentary canal of the larva ends blindly. As the writer has demonstrated its completeness in *Philonix nigra* Gillettee (Fig. 10), and *Amphibolips confluens* Harris, this is probably the case in all of the species. The correct explanation for the absence of frass is that the larva uses as food only the cell contents of the nutritive zone, and these have been rendered capable of complete absorption by the amylalytic ferment in the larval secretion. A very marked feature of the nutritive zone of the galls is the gradual collapsing of the cells as their contents are removed. Compare Figs. 6 and 7. Since the cell walls lining the Cynipid larval chamber are not broken by the larva in feeding, the interior of the cavity remains smooth, a marked contrast to the ragged, broken edge of tissue left where an inquiline larva has been feeding. A comparison of Figs. 8 and 9 will demonstrate this. The difference in the nature of the food is shown in the stomach contents of the Cynipid and the inquiline larva. The former consists of a mass of extremely fine particles, among which can be detected nothing that is recognizable as having formed a part of a cell (Fig. 8). but the latter is composed of much coarser material in which crystals and parts of cell walls can be easily detected (Fig. 9).

As well as thus acting as a pre-digestive factor the ferment in the larval salivary secretion has an indirect action on the production of the gall. Owing to its influence the nutritive zone will become stored with an unusually large amount of available nourishment which can diffuse to all parts of 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 explainable as the response of the protoplasm of the host to the additional food supply.

Description of Plates 2 and 3.

Fig. 1. *Rhabdophaga triticoides* Walsh on the stem of *Salix cordata* Muhl. Transverse section of a young gall, in which is shown the general arrangement of the larval chambers and the distribution of aeriferous tissue throughout the cortex and pith of the gall. The edges of three larval chambers are bounding the pith of the gall. ×50.

Fig. 2. *Eurosta solidaginis* Fitch on the stem of *Solidago canadensis* L. Transverse section showing the proliferation of glandular tissue. ×25.

Fig. 3. *Cecidomyia ocellaris* O.S. on the leaf of *Acer rubrum* L., showing the almost unchanged character of the leaf immediately below the larva, and the great amount of proliferation in the region surrounding it. ×30.

Fig. 4. *Eriophyes* sp. (*Fagus grandifolia* Ehrh.) Section through a number of capitate trichomes. The almost normal character of the leaf is shown. ×50.

Fig. 5. *Eriophyes* sp. (*Acer negundo* L.) Section through the gall, showing a large number of convoluted trichomes. ×35.

Fig. 6. *Dryophanta palustris* O.S. on the leaf of *Quercus velutina* Lam. Section of a very early stage in which the inner and outer galls are still in contact. ×30.

Fig. 7. *Dryophanta palustris* O.S. on the leaf of *Quercus velutina* Lam. Section of the larval chamber of a mature specimen, showing the insect breaking out of the inner gall. At this stage the nutritive layer has entirely collapsed. ×15.

FIG. 8. *Holeaspis bassetti* Gillette on the stem of *Quercus macrocarpa* Michx. Section through the gall cavity with enclosed larva. The character of the cells of the nutritive zone is shown and the unbroken edge of the inside boundary. ×60.

FIG. 9. Section of a larval inquiline from the gall *Holcaspis bassetti* Gillette. The broken edge of the tissue on which the larva has been feeding is shown, also the comparatively coarse material of the stomach contents. ×60.

FIG. 10. *Philonix nigra* Gillette. Longitudinal section of the larva, showing the external opening of the alimentary canal. ×15.

FIG. 11. *Philonix nigra* Gillette. Longitudinal section of the head of the larva passing through a salivary gland and its associated duct. The opening is just below the mouth. ×40.

FIG. 12. *Rhabdophaga strobiloides* Walsh on the stem of *Salix cordata* Muhl. Longitudinal section, showing the larva in contact with the small-celled tissue at the apex of the stem. ×25.

FIG. 13. *Pontania hyalina* Norton on *Salix alba* L. Section of gall with larva still within the egg membrane. Proliferation is shown well advanced in all the tissues of the leaf. ×35.

ANTS.

(Abstract of Illustrated Lecture on "Ants," by Prof. W. M. Wheeler.)

By way of preface the lecturer made some general statements in regard to the 5,000 known species and sub-species of ants, and 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 behaviour of ants was treated from the standpoint of the three basic biological activities, namely reproduction, nutrition and protection.

Special emphasis was placed on the behaviour of the female, or queen ant and her methods of establishing the colony in contrast with the behaviour 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.

The peculiar structure of the ant's alimentary tract 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 adaptations 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 havesting 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 *Cremastogaster, 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 pre-arranged 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 at Windsor soon after noon, but owing to a very severe thunderstorm the previous evening the electric cars were running very irregularly and it was not until about 2 p.m. that the party 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. Cæsar, 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.

THE ENTOMOLOGICAL RECORD, 1913.

ARTHUR GIBSON, CHIEF ASSISTANT ENTOMOLOGIST, DIVISION OF ENTOMOLOGY, OTTAWA.

The season of 1913, in most parts of Canada, has been favorable for systematic work in entomology. In many districts the cold, backward spring was followed by perfect weather for collecting, and in consequence, in many localities, interest was awakened which resulted in valuable work being accomplished. In British Columbia, largely through the revival of the B.C. Branch of the Entomological Society of Ontario, collections were made at several points; throughout the prairie provinces new collectors were heard from, and in the older settled districts of eastern Canada, entomologists took advantage of the continued favorable weather to gather many species, and in certain groups which had been somewhat neglected, large series of specimens were secured, which added new records and much information as to distribution. At the field stations of the Division of Entomology, which have been recently established in the different provinces, the officers in charge have made collections of insects in their respective districts and these will be added to from year to year, and the material worked up by specialists.

During 1913, as far as we know, no special expeditions were made to Canada for the purpose of collecting insects. Small collections were made in the Yukon Territory and other distant places, by members of Dominion Government survey parties. Dr. E. M. Walker, of Toronto, made a collecting trip, particularly to certain parts of British Columbia and brought back many specimens. Some of the officers of the Division of Entomology while visiting western Canada officially, gathered material at various points. Dr. C. Gordon Hewitt collected ants and bees and new records were obtained. Mr. J. M. Swaine spent July, August and September in British Columbia and made important collections of certain groups of coleoptera. The writer collected interesting species in Manitoba, Alberta and British Columbia.

It is again our pleasant duty to acknowledge the continued assistance received in the determination of material from the recognized authorities in the United States and elsewhere. Particular acknowledgment is due to Dr. L. O. Howard and his associates at Washington—Dr. Dyar, Dr. Banks, Messrs. Schwarz, Crawford, Busck, Rohwer and Knab; Sir George F. Hampson of the British Museum; Mr. W. D. Kearfott, of Montclair, N.J.; Prof. H. F. Wickham, of Iowa City, Iowa; Mr. E. P. Van Duzee, of San Diego, Cal.; Mr. J. A. Grossbeck, of New York; Dr. Henry Skinner, of Philadelphia, Pa.; Dr. E. M. Walker, of Toronto, Ont.; Col. Thos. L. Casey, of Washington, D.C.; Mr. C. W. Johnson, Boston, Mass.; Mr. Chas. Liebeck, of Philadelphia, Pa.; Mr. F. H. Wolley-Dod, of Midnapore, Alta.; Mr. J. D. Evans, of Trenton, Ont.; Prof. H. S. Hine, of Columbus, Ohio; Mr. Chas. W. Leng, New York, N.Y.; Prof. J. M. Aldrich, La Fayette, Ind., and Dr. W. G. Dietz, of Hazleton, Pa.

LITERATURE.

Among the publications which have been issued during 1913, and which are of interest to Canadian students, mention may be made of the following:—

AULMANN, G. Psyllidarum catalogus: W. Junk, Berlin, 1913. We are glad to see a catalogue of the Homopterous family Psyllidæ, published by the well

known firm of W. Junk, Berlin. It is gotten up in the same style as the Coleopterorum catalogus, which is now becoming familiar to coleopterists. This catalogue includes the species of the world and is complete in 92 pages. It will certainly prove of value to students of that family and they should know of its existence.—*Entomological News,* March, 1913.

Barnes, W., and McDunnough, J. H. Contributions to the Natural History of the Lepidoptera of North America: Decatur, Ill. (to be obtained from Dr. W. Barnes). Vol. II, No. 1—Illustrations of Rare and Typical Lepidoptera (continued), 21 plates, issued March 10, 1913; Vol. II, No. 2.—The N. American species of the Liparid Genus Olene, pp. 47-76, plates 1-7, issued April 15, 1913; Vol. II, No. 3—New N. Am. Lepidoptera with notes on described species, pp. 93-146, plates 1-9. We were very glad, indeed, to receive the above additional numbers of the Contributions. They are valuable publications and the illustrations, on the whole, are excellent and very helpful.

Casey, Thos. L. Memoirs on the Coleoptera, IV; published by the New Era Printing Company, Lancaster, Pa., issued Nov. 30, 1913, pp. 400. This fourth Memoir is divided into two parts: I.—Studies in the Cicindelidæ and Carabidæ of America; II.—Further Studies among the American Longicornia. In Part I., 186 species are described as new (10 of which are from Canada), and 56 as new subspecies; of these latter seven are from Canada. In Part II, 227 beetles are described as new species (four of these are from Canada) and 21 as new subspecies (none from Canada).

Faull, J. H., et al. The Natural History of the Toronto Region, Ontario, Canada: The Canadian Institute, 1913, 419 pp. In this most interesting volume (received 13 Sept., 1913), chapter XIII, is devoted to Insect Galls of the Vicinity of Toronto (By Dr. A. Cosens), and chapter XXII to Insects and their Allies (By Dr. E. M. Walker). In this latter chapter, which occupies pages 295 to 403, lists are presented of insects, in the various orders, which are known to have been collected in the district of Toronto. Altogether 2,488 species are listed, as follows: Orthoptera 61; Dermatoptera 1; Plecoptera 2; Ephemerida 12; Odonata 60; Hemiptera 92; Neuroptera 8; Trichoptera 5; Coleoptera 1,079; Lepidoptera 619; Hymenoptera 263; Diptera 249. Unfortunately, entomologists are few in Toronto, and comparatively little systematic collecting has been accomplished outside of two or three of the better known orders, and even in these the work has been confined largely to certain families. The lists presented are of much value and will it is hoped lead to greater zeal in collecting so that many additions may be made.

Folsom, J. W. Entomology with special reference to its Biological and Economic Aspects; Second Revised Edition, with four plates and 304 text figures, Philadelphia: P. Blakeston's Son & Co., 1913; price $2.25.

The new revision of this very useful book contains only 402 pages as compared with 485 pages in the first edition. This is due to the fact that the type form has been enlarged to 4½ x 7 inches; the paper is also a little thinner. Much additional information is given in the new volume. Chapters I to VI remain with the same titles; chapter VII on "Origin of Adaptations and of Species" is omitted; chapters VIII and IX, correspond to VII and VIII of the new edition; in the latter, chapter IX "Transmission of Diseases by Insects" is new; chapters X, XI, XII and XIII remain with the same titles. Additions have been made to the bibliography at the end of the volume. The coloured plate illustrating protective mimicry among butterflies does not appear in the Revision.

FRANKLIN, HENRY J. The Bombidæ of the New World: Trans. Amer. Ent. Soc. XXXVIII, pp. 177-486 (issued Jan., 1913); XXXIX, pp. 73-200, plates I-XXII (issued July, 1913). This extremely valuable monograph, the appearance of which has been eagerly looked forward to, is now available for students of the hymenoptera. Chapters on "Characters of the Bombidæ," "Geographical Distribution," "Climatic Variations," "Economic Importance," "External Anatomy," etc., precede the systematic discussion of the species. The first part treats of "Species north of Mexico," and the second, "Species south of the United States." In Part I, four species are described as new and one as a new subspecies; one of the new species is from Newfoundland. Thirty-seven species of Bombidæ occur north of the United States.

GROSSBECK, JOHN A. Bibliography of the published writings of Professor John B. Smith. Proceedings of the Staten Island Association of Arts and Sciences, Vol. IV. A copy of this bibliography has recently been received. Students of Lepidoptera will welcome this list of the writings of our late friend. In this order alone 144 references are given to published papers.

HAMPSON, SIR GEORGE F. (Bart.). Catalogue of the Lepidoptera Phalænæ in the British Museum, Vol. XII, Noctuidæ, 1913, 626 pp., plates cxcii-ccxxi, received 18th March, 1913. In this volume the subfamily Catocalinæ (in part) is classified; 63 genera embracing 643 species are presented; these are characterized as follows: "Vein 5 of the hind wing is fully developed and arises from close to the lower angle of the cell; the eyes are smooth and not overhung by 'cilia'; the mid tibiæ are always spined, and the fore and hind tibiæ may also be similarly armed." This volume is of much value to North American students, including as it does many species known in American literature under the genus *Catocala*. Records of 109 species from North America are given, 35 of which are from Canada. The beautiful plates which accompany the volume are excellent in every way.

HEWITT, C. GORDON. Bibliography of Canadian Entomology for 1911: Ottawa; Trans. Royal Soc. of Can., Third Series—1912, Vol. VI, Section IV. This useful annual publication, which is now compiled by Dr. Hewitt, will be found of much interest especially to Canadian workers. References to 116 papers are given. A new addition is the subject index which appears at the beginning.

HOWARD, L. O., DYAR, H. G. and KNAB, F. The Mosquitoes of North and Central America and the West Indies: Washington, D. C., published by the Carnegie Institution of Washington. Volume One: A general consideration of Mosquitoes, Their Habits and Their Relations to the Human Species; issued Jan. 21, 1913. Volume Two: Plates; issued Feb. 24, 1913. It is impossible in the space available here to more than simply note the appearance of the first two volumes of this monumental work on mosquitoes. Volume One consists of 520 pages. Immediately following the introduction, the "Early accounts of Mosquitoes" are discussed, followed by chapters on the structure of the adult, the larva, etc. Extensive chapters on collecting, etc., the relation of mosquitoes to man, economic loss from mosquitoes, examples of mosquito control, etc., contain most valuable and exceedingly interesting matter. The arrangement of the text, the illustrations, etc., are excellent in every way. Volume Two consists entirely of plates, to the number of 150. Plate 1 shows a diagram of culicid larvæ; plates 2-40 illustrate the male genitalia of 270 species; plate 41 shows the wings of 22 species of anophelines; plates 42-85 illustrate mature larvæ; plates 86-129, details of larvæ;

plate 130, larval float-hairs; plate 131, head of larva, ventral view; plates 132-135, maxillæ of larvæ; plates 136-138, mandibles of larvæ; plates 139-144, mental plates of larvæ; plates 145-147, eggs; plates 148-150, pupæ.

METCALF, C. L. The Syrphidæ of Ohio: Ohio Biological Survey, Bulletin No. 1, Vol. I.; Ohio State University, Columbus, 1913, pp. 7-122, plates i to xi. This extremely valuable contribution is very welcome. The insects of this family are of very considerable economic importance. The paper is divided into three parts: Part I.—General discussion of the family, characters, etc.; Part II.—Key to known larvæ, synopsis of life-history studies, etc.; Part III.—Keys to genera, species, etc. This bulletin will be of special use to Ontario students.

MORLEY, CLAUDE. A Revision of the Ichneumonidæ based on the Collection in the British Museum (Natural History) with Descriptions of New Genera and Species: British Museum (Natural History), 1913. Part II., Tribes Rhyssides, Echthromorphides, Anomalides and Paniscides; pp. 140, 1 plate (coloured). This is a continuation of the "Revision" commenced by the same author in 1912. In this second part 291 species are included, 71 of which are described as new. Records are given of 7 species from Canada, which are in the British Museum; 2 of these are described as new. Among the North American species treated of, several not represented in the British Museum occur in Canada.

WHEELER, WILLIAM MORTON. A Revision of the Ants of the Genus Formica (Linné) Mayr; Bulletin of the Museum of Comparative Zoology, Vol. LIII, No. 10, Cambridge, Mass., October, 1913. In this most useful contribution, pp. 379-565, the author recognizes 31 species, 19 subspecies, and 43 varieties as belonging to the North American fauna. Many Canadian records are given, and several species, subspecies, and varieties are described as new. One form which occurs in Canada is given specific rank. The taxonomic and other notes given after many of the descriptions will be found of much value to students of these insects. In order to facilitate the identification of the various species, subspecies, and varieties of Formica the author gives dictotomic tables of the worker phases, as well as tables of the females of the *rufa* and *microgyna* groups.

The following is a list of the names and addresses of collectors heard from during 1913:

Anderson, E. M., Provincial Museum, Victoria, B.C.
Baird, Thos., High River, Alta.
Beaulieu, G., Experimental Farm, Ottawa.
Beaulne, J. I., Experimental Farm, Ottawa.
Bethune, Rev. Prof., O.A.C., Guelph.
Blackmore, E. H., Victoria, B.C.
Brimley, J. F., Grimsby, Ont.
Brittain, W., Agric. College, Truro, N.S.
Bush, A. H., 1105 Broadway, Vancouver, B.C.
Caesar, L., O.A.C., Guelph, Ont.
Chagnon, Gus., Box 521, Montreal.
Chagnon, W., St. John's, Que.
Chandler, Frank S., Kaslo, B.C.
Cockle, J. W., Kaslo, B.C.

Cosens, Dr. A., Parkdale Collegiate Institute, Toronto.
Crew, R. J., 561 Carlaw Ave., Toronto.
Criddle, Evelyn, Aweme, Man.
Criddle, Norman, Aweme, Man.
Dawson, Horace, Hymers, Ont.
Day, G. O., Duncans, B.C.
Dod, F. H. Wolley-, Midnapore, Alta.
Emile, Rev. Bro., Longueuil, Que.
Evans, J. D., Trenton, Ont.
Fyles, Rev. Dr. T. W., 368 Frank St., Ottawa.
Germain, Rev. Bro., 125 Empress St., Ottawa.
Gibson, Arthur, Experimental Farm, Ottawa.
Hahn, Paul, 433 Indian Road, Toronto.
Haight, D. H., Sudbury, Ont.
Hanham, A. W., Duncans, B.C.
Harrington, W. H., P. O. Dept., Ottawa.
Heath, E. F., Cartwright, Man.
Hewitt, Dr. C. Gordon, Experimental Farm, Ottawa.
Hudson, H. F., Strathroy, Ont.
Keen, Rev. J. H., Metlakatla, B.C.
Kitto, V., Inland Revenue, Dept. Interior, Ottawa.
Leavitt, A. G., St. John, N.B.
Lyman, H. H., 74 McTavish St., Montreal.
McIntosh, W., St. John, N.B.
Mignault, Rev. J. B., Ste. Therese, Que.
Moore, G. A., 850 St. Hubert St., Montreal.
Metcalfe, W., 134 O'Connor St., Ottawa.
Nicholls, Arch., Sault Ste. Marie, Ont.
Perrin, Jos., McNab's Island, Halifax, N.S.
Petch, C. E., Covey Hill, Que.
Richard, Rev. A. E., Perkins, Que.
Ross, W. A., Vineland Station, Ont.
Sanders, G. E., Bridgetown, N.S.
Sanson, N. B., Banff, Alta.
Simpson, W., Dominion Observatory, Ottawa.
Simms, H. M., 192 Ontario East, Montreal.
Sladen, F. W. L., Experimental Farm, Ottawa.
Stewart, G. M., 83 Smith St., Winnipeg, Man.
Strickland, E. H., Experimental Station, Lethbridge, Alta.
Swaine, J. M., Experimental Farm, Ottawa.
Tothill, J. D., Fredericton, N.B.
Treherne, R. C., Agassiz, B.C.
Venables, E. P., Vernon, B.C.
Walker, Dr. E. M., Univ. of Toronto, Toronto.
Wallis, J. B., Machray School, Winnipeg, Man.
Willing, Prof. T. N., Univ. of Saskatchewan, Saskatoon, Sask.
Wilson, Tom, 1105 Broadway, Vancouver, B.C.
Winn, A. F., 32 Springfield Ave., Westmount, Que.
Young, C. H., Victoria Memorial Museum, Ottawa.

NOTES OF CAPTURES.

(Species preceded by an asterisk (*) described during 1913.)

Lepidoptera.

(Arranged according to Dyar's List of North American Lepidoptera, U.S. Nat. Museum Bull. No. 52.)

(Dyar's number.)

65. *Eurymus eurytheme* Bdv. McNab's Island, Halifax, N.S., Oct. 25, 1912; first record for the district, (Perrin).
134. *Brenthis triclaris* Hbn. Prince Albert, Sask., June 26, (Walker).
869. *Neoarctia yarrowi* Stretch. Banff, Alta., 7,500 ft. elevation on Sulphur Mt., July 9, (Sanson).
878. *Apantesis parthenice* Kirby. A perfect specimen of this species with yellow hind-wings was received from Mr. Norman Criddle, taken at Aweme, Man., Aug. 12. This is the only specimen of this species which I have seen with yellow secondaries, (A. G.).
1021. *Apatela marmorata.* Sm. Duncan, Vanc. Is., B.C., (Day). New to British Columbia.
1084. *Catabena lineolata* Walk. Cartwright, Man., first I have taken, (Heath).
1147. *Hillia discinigra* Walk. Montreal, Que., Sept. 21, 1912, (Winn). New to Quebec list.
1224. *Hadena finitima* Gn. Quamichan Lake, B.C., May 22, a pair at sugar; the first specimens taken here, (Hanham).
1254. *Epidemas cinerea* Sm. Victoria, B.C., Oct. 2, (Hanham).
1269. *Polia extincta* Sm. Cartwright, Man., Aug. 1, (Heath).
1273. *Polia contadina* Sm. Quamichan Lake, B.C., Sept. 15, (Hanham).
1289. *Trachea delicata* Grt. St. John's, Que., July 16, (W. Chagnon); Montreal (Aug.) only record in Winn's Quebec list.
1335. *Oncocnemis homogena* Grt. Hope Mountains, B.C., July 26, 1908, (Day). New to British Columbia.
1419. *Platagrotis condita* Gn. Quamichan Lake, B.C., May 26, (Hanham).
1500. *Noctua havilæ* Grt. Duncan, Van. Is., B.C., (Day). New to British Columbia.
1588. *Paragrotis brocha* Morr. Duncan, Vanc. Is., B.C., (Day).
1593. *Paragrotis hollemani* Grt. Duncan, Vanc. Is., B.C., (Day). New to Canada.
1702. *Paragrotis infausta* Walk. Quamichan Lake, B.C., Aug. 13, Sept. 1, (Hanham).
1740. *Paragrotis pinder* Sm. Quamichan Lake, B.C., Sept. 9, (Hanham).
* *Mamestra mutata* Dod. Calgary, Alta., June 22-Aug. 9, (Dod); Mineota, Cartwright, Winnipeg, Man., Aug. 3-Sept. 20, (Dennis, Heath and Hanham); Can. Ent. Vol. XLV, 29.
2185. *Papaipema unimoda* Sm. Cartwright, Man., Sept. 5, (Heath).
2210. *Pseudoglæa blanda* Grt. Duncan, Vanc. Is., B.C., (Day).
* *Parastichtis lignicolora atriclava* B. & McD. Duncan, Vanc. Is., B.C., (Hanham); Contributions to the Nat. Hist. of the Lep. of N. A., Vol. II, No. 3, issued April 15, 1913.

* *Parastichtis purpurissata* B. & McD. Duncan, Vanc. Is., B.C., (Hanham). Contributions to the Nat. Hist of the Lep. of N. A., Vol. II, No. 3, issued April 15, 1913.

2244 *Scopelosoma devia* Grt. Bridgetown, N.S., April 15 (Sanders).

2617. *Eustrotia includens,* Wlk. Cartwright, Man., July 25, (Heath).

2977. *Pheocyma horrida* Hbn. Ste. Therese Island, near St. John's, Que., July 1, (W. Chagnon). New to Quebec list.

3002. *Pheocyma duplicata* Bethune. Bridgetown, N.S., June 28, (Sanders).

* *Olene vagans vagans* B. & McD. St. John's, Que., July 1 and 11 (Chagnon); Windsor Mills, Que., July 4, (Winn); Contributions to the Nat. Hist. of the Lep. of N. A., Vol. II, No. 2, April 15, 1913. New to Quebec list.

* *Olene vagans grisea* B. & McD. Cartwright, Man., (Heath); Pincher, Alta., (Willing); Kaslo B.C., July 8-20, (Cockle); Contributions to the Nat. Hist. of the Lep. of N. A., Vol. II, No. 2, April 15, 1913.

* *Olene vagans willingi* B. & McD. Humbolt, Sask., June 13 and 27, (Willing); Hymers, Ont., (Dawson); Contributions to the Nat. Hist. of the Lep. of N. A., Vol. II, No. 2, April 15, 1913.

Olene pini Dyar. St. John's, Que., (Chagnon). New to Quebec list.

3353. *Eustroma nubilata* Pack. St. John's, Que., July 1, (W. Chagnon); Rimouski, (Aug.), only record in Winn's Quebec list.

Mesoleuca walkerata Pearsall. Newaygo, Laurentian Mts., Que., July 5, (G. A. Southee). New to Quebec list.

Hydriomena transfigurata Swett. Nipigon, Ont., June 18, (Walker).

* *Ania limbaria* var. *chagnoni* Swett. Ste. Therese Isle, St. John's, Que., July 9, 1912, (Chagnon); Can. Ent., Vol. XLV, 76.

4211. *Sesia novaroensis* Hy. Edw. Victoria, B.C., Aug. 7, 1911, (Blackmore); Departure Bay, B.C., July 24, (Walker).

4587. *Crambus ruricolellus* Zell. Bridgetown, N.S., Aug. 19, (Sanders).

4802. *Megasis atrella* Hulst. Cartwright, Man, May 16, (Heath).

5033. *Olethreutes capreana* Hbn. Ottawa, July 15, 1902, (J. Fletcher).

5045. *Olethreutes roseomaculana* H. S. High River, Alta., July 7, 1907, (Baird).

5047. *Oleuthreutes chionosema* Zell. Guelph, Ont., (Caesar).

5142. *Eucosoma otiosana* Clem. Bridgetown, N.S., Aug. 8, 1912, (Sanders).

5143. *Eucosoma similana* Hbn. Bridgetown, N.S., Sept. 2, 1912, (Sanders).

5335. *Cenopis reticulana* Clem. Bridgetown, N.S., Aug. 16, (Sanders).

5348. *Sparganothis puritana* Rob. Cartwright, Man., July 12, (Heath).

5391. *Pandemis limitana* Rob. Bridgetown, N.S., Aug. 15, (Sanders).

5396. *Tortrix pallorana* var. *nervosana* Kearf. Bridgetown, N.S., Aug. 9, 1912, (Sanders).

5489. *Periclymenobius dentiferellus* Wlsm. Cartwright, Man., Aug. 26, (Heath).

5868. *Depressaria klamathiana* Wlsm. Ottawa, Sept. 11, 1908, (J. Fletcher).

5893. *Semioscopsis packardella* Clem. Cartwright, April 28, (Heath).

5895. *Semioscopsis inornata* Wlsm. Cartwright, Man., April 11, (Heath).

6514. *Tinea misella* Zell. Ottawa, June 18, 1906, (J. Fletcher).

COLEOPTERA.

(Arranged according to Henshaw's list of the Coleoptera of America, North of Mexico.)

Omophron concinnum Csy. Rare in damp sandy stretches along the Cowichan River, near Duncan, Vanc. Is., B.C., May, (Hanham).

86. *Cychrus elevatus* Fab. Birds Hill, (near Winnipeg), Man., May 24, (Hanham).

Carabus nemoralis, Mull. Montreal, Que., June 26, (Bro. Germain). In the Can. Ent., Vol. 24, 112, Mr. W. H. Harrington records this species as well as *C. granulatus* Dej., from St. John, N.B. Mr. G. Beaulieu has also taken *C. nemoralis* at this latter place. (See also Ent. Rec. 1901). The occurrence of the species on Mount Royal, Montreal, is of interest.

* *Cicindela montana canadensis* Csy. Calgary, Alta.

* *Cicindela spissitarsis* Csy. Aweme, Man., (N. Criddle).

* *Cicindela criddlei* Csy. Aweme, Man., (N. Criddle).

* *Cicindela limbigera nympha* Csy. Aweme, Man., (N. Criddle).

* *Cicindela limbalis awemeana* Csy. Aweme, Man., (N. Criddle).

* *Cicindela decemnotata albertina* Csy. Lethbridge, Alta.

* *Cicindela venusta versuta* Csy. Aweme, Man., (N. Criddle).

* *Cicindela kirbyi* Csy. Aweme, Man., (N. Criddle).

* *Cicindela bucolica* Csy. Aweme, Man., (N. Criddle).

The above new species and new subspecies are described in Memoirs on the Coleoptera, IV, by Thos. L. Casey, issued Nov. 30, 1913.

155. *Elaphrus fuliginosus* Say. Aylmer, Que., July 13, (Bro. Germain).

156. *Elaphrus lecontei* Cr. Winnipeg, Man., June 17, 1911, (Wallis).

164. *Blethisa quadricollis* Hald. Longueuil, Que., May, (Bro. Emile).

173. *Notiophilus æneus* Hbst. Ottawa, Nov. 1, 1902, (Harrington).

178. *Notiophilus sibiricus* Mots. Ottawa, April 13, 1883, (Harrington); Kingsmere, Que., (Simpson).

* *Leistus nigropiceus* Csy. Metlakatla, B.C., (Keen); Memoirs on the Coleoptera, IV, Nov. 30, 1913, by Thos. L. Casey.

* *Nebria columbiana* Csy. Inverness, B.C., (Keen); Memoirs on the Coleoptera, IV, Nov. 30, 1913, by Thos. L. Casey.

* *Nebria testaceipes* Csy. "British Columbia: Glenora," (Wickham); Memoirs on the Coleoptera, IV, Nov. 30, 1913, by Thos. L. Casey.

191. *Nebria obtusa* Lec. Lethbridge, Alta., Aug. 21, 1912, (Wallis).

262. *Clivina punctulata* Lec. Duncan, Vanc. Is., early in spring, along the Cowichan River, (Hanham).

316. *Bembidium bifossulatum* Lec. Brandon, Man., rare, Oct. 8, (Hanham).

322. *Bembidium longulum* Lec. Winnipeg, Man., Oct. 24, 1911, (Wallis).

337. *Bembidium 4-foveolatum* Mann. Peachland, B.C., July 12, 1912, (Wallis).

349. *Bembidium bimaculatum* Kirby. Husavick, Man., July 24, 1912, (E. (Coates).

375. *Bembidium indistinctum* Dej. Victoria, B.C., July 4, 1912, (Wallis).

380. *Bembidium variolosum* Mots. Lethbridge, Alta., July 21, 1912, (Wallis).

462. *Tachys granarius* Dej. Winnipeg, Man., June 6, 1911, (Wallis).

483. *Trechus chalybeus* Mann. Selkirk, Man., June 10, 1911 (Wallis).

509. *Pterostichus castaneus* Dej. Mt. Arrowsmith, 4,500 ft. elevation, June 26, (Hanham).

567. *Pterostichus convexicollis* Say. Hull, Que., April 27; Aylmer, Que., May 11; Ottawa, April 26, (Beaulne).

* *Holciophorus vancouveri* Csy. Victoria, Vanc. Is., B.C.; Memoirs on the Coleoptera, IV, Nov. 30, 1913, by Thos. L. Casey.

* *Pterostichus novellus* Csy. "Vancouver Island"; Memoirs on the Coleoptera, IV, Nov. 30, 1913, by Thos. L. Casey.

* *Pterostichus metlakatlæ* Csy. Metlakatla, B.C., (Keen); Memoirs on the Coleoptera, IV, Nov. 30, 1913, by Thos. L. Casey.

* *Pterostichus scenicus* Csy. "British Columbia"; Memoirs on the Coleoptera, IV, Nov. 30, 1913, by Thos. L. Casey.

* *Calathus labradorinus* Csy. West St. Modest, Labrador; Memoirs on the Coleoptera, IV, Nov. 30, 1913, by Thos. L. Casey.

667. *Amara protensa* Putz. Ottawa, April 23, (Beaulne).

678. *Amara remotestriata* Dej. Ottawa, Aug. 16, (Beaulne).

821. *Platynus bogemanni* Gyll. Vernon, B.C., (Brittain).

822. *Platynus quadripunctatus* DeG. Under logs on sandy banks of Cowichan River, near Duncan, Vanc. Is., B.C., Nov. 8, (Hanham).

823. *Platynus bembidioides* Kirby. Duncan, Vanc. Is., only two specimens taken in British Columbia, in 12 years, (Hanham).

851. *Galerita janus* Fab. Montreal, Que., Nov. 12, 1899, (Beaulieu).

852. *Galerita lecontei* Dej. Winnipeg, Man., Oct. 4, 1912, (Wallis).

884. *Lebia pleuritica* Lec. Winnipeg, Man., June 13, 1912, (Wallis).

898. *Lebia depicta* Horn. Lethbridge, Alta., Aug. 23, 1912, on solidago, (Wallis).

915. *Axinopalpus biplagiatus* Dej. Victoria, B.C., Oct. 15, (Hanham).

1021. *Chlænius pennsylvanicus* Say. Swan Lake, B.C., appears to be rare species in Brit. Col., only one specimen taken, June, (Hanham).

1031. *Chlænius purpuricollis* Rand. Brandon, Man., (Hanham).

1060. *Agonoderus infuscatus* Dej. Ottawa, May 3, (Bro. Germain).

1118. *Harpalus varicornis* Lec. Ottawa, May 14, (Beaulne).

1137. *Stenolophus anceps* Lec. Cowichan River, near Duncan, Vanc. Is., B.C., under logs, Nov. 8, (Hanham).

1166. *Tachycellus atrimedius* Say. Winnipeg, Man., (Hanham).

1222. *Haliplus borealis* Lec. Ottawa, Sept. 21, (Beaulne).

* *Haliplus subguttatus* Robert. Antigonish, N.S., (Swaine); Montreal, Que., (Chagnon); Aweme, Man., (N. Criddle); Peachland, B.C., Husavick and Winnipeg, Man., (Wallis); Jour. N. Y. Ent. Soc. Vol. XXI, June, 1913.

* *Haliplus strigatus* Roberts. Treesbank and Stony Mt., Man., (Wallis); Aweme, Man., (N. Criddle); Frazer Valley, B.C., (G. Weidt); Jour. N. Y. Ent. Soc. Vol. xxi, June, 1913.

* *Peltodytes tortulosus* Roberts. Winnipeg Beach, Man., (Wallis); Aweme, Man., (N. Criddle); Jour. N. Y. Ent. Soc. Vol. XXI, June, 1913.

1233. *Cnemidotus edentulus* Lec. Ottawa, Sept. 23, (Beaulne).

1378. *Ilybius ater* DeG. Ottawa, June 28, (Beaulne).

1385. *Ilybius ignarus* Lec. Ottawa, June 11, (Beaulne).

(9300) *Agabus confinis* Gyll. Ottawa, June 20, (Bro. Germain).

1466. *Rhantus bistriatus* Bergst. Ottawa, July 18, (Bro. Germain); July 9, 1912, (Beaulne).

1478. *Hydaticus lævipennis* Thom. Ottawa, June 12, (Bro. Germain).

1493. *Acilius fraternus* Harr. Lake Abitibi, Ont., Aug. 26, (W. S. Odell).
1496. *Thermonectes basilaris* Harr. Hull, Que., Nov. 2, (Beaulne).
1579. *Ochthebius holmbergi* Makl. Winnipeg, Man., May 20, 1910, (Wallis).
1589. *Hydrophilus nimbatus* Say. Winnipeg Beach, Man., Aug. 5, 1910, (Wallis); Ottawa, June 3, (Bro. Germain).
1724. *Catoptrichus frankenhaeuseri* Mann. Duncan, B.C., (Hanham).
2004. *Fagaria venustula* Er. E. Ont., (Evans).
Atheta fungi Grav. Ottawa, June 13, (Beaulne).
Atheta sordida Marsh. Ottawa, Aug. 21, (Beaulne).
Aleochara defecta Csy. Ottawa, Aug. 14, (Beaulne).
(9557) *Aleochara morion* Grav. Ottawa, Aug. 21, (Beaulne).
Aleochara thoracica Csy. Ont., (Evans).
Oxypoda demissa Csy. E. Ont., (Evans).
Oxypoda orbicollis Csy. E. Ont., 1884, (Evans).
Oxypoda tenuicula Csy. E. Ont., (Evans).
Oxypoda stygica Csy. Trenton, Ont., Sept. 23, 1904, (Evans).
Pasilia virginica Csy. E. Ont., (Evans).
Micrearota reperta Csy. E. Ont., (Evans).
Datomicra vaciva Csy. E. Ont., 1884, (Evans).
Acrotona adjuvans Csy. E. Ont., (Evans).
Traumecia tenuicula Csy. E. Ont., (Evans).
Coprothassa sordida Marsh. E. Ont., Sept. 1883, (Evans).
2079. *Gyrophæna flavicornis* Mels. Ont., (Evans).
2326. *Stenus scrupeus* Csy. E. Ont., (Evans).
2364. *Stenus pusia* Csy. E. Ont., (Evans).
2389. *Stenus vinnulus* Csy. E. Ont., 1886, (Evans).
2401. *Stenus juvencus* Csy. E. Ont., (Evans).
2451. *Stenus canadensis* Csy. E. Ont., (Evans).
(9745) *Trogophlœus temporalis* Csy. Trenton, Ont., Sept. 24, 1904, (Evans).
3071. *Harmonia* 14-*guttata* Linn. Aweme, Man., on *Acer negundo*, June, (E. Criddle).
3421. *Dermestes talpinus* Mann. Ottawa, May 19, (Bro. Germain).
(9944) *Hister electus* Csy. Victoria, B.C., in moss on large boulder, late in fall, (Hanham).
3665. *Cercus pennatus* Murr. Ottawa, June, (Bro. Germain).
3725. *Prometopia* 6-*maculata* Say. Ottawa, June 29, (Beaulne); Montreal, Que., June, (Beaulieu).
3898. *Syncalypta echinata* Lec. Brandon, Man., under stones on hilltops, (Hanham).
3971. *Macropogon testaceipennis* Mots. Mt. Tzouhalem, Vanc. Is., B.C., June 14, (Hanham).
(10021) *Melasis rufipennis* Horn. Quamichan, B.C., flying around and alighting on stacked cord wood, June 1; never taken on any other occasion (Hanham).
4031. *Dromœolus basalis* Lec. Victoria, B.C.; Duncan, B.C., August, rare, (Hanham).
4064. *Anelastes drurii* Kirby. Aweme, Man., Aug. 25, 1905, (N. Criddle).
4074. *Adelocera pyrsolepis* Lec. Victoria, B.C., (Hanham).
4082. *Adelocera brevicornis* Lec. Aweme, Man., May, Aug., (N. Criddle).

4083. *Adelocera profusa* Cand. Victoria, B.C., (Hanham).
4095. *Alaus melanops* Lec. Quamichan Lake, B.C., under bark of stump, March, (Hanham).
4113. *Cardiophorus tenebrosus* Lec. Quamichan Lake, B.C., (Hanham).
4143. *Cryptohypnus funebris* Cand. Cowichan River, near Duncan, B.C., (Hanham).
4148. *Cryptohypnus impressicollis* Mann. Aweme, Man., May 25, 1909, (N. (Criddle).
(10054) *Cryptohypnus caurinus* Horn. Cowichan River, near Sahtlam, B.C., June, (Hanham).
4219. *Elater mixtus* Hbst. Aweme, Man., June 22, 1904, June 27, 1905, (N. Criddle).
4237. *Elater lateralis* Lec. Quamichan Lake, B.C., Sept. 29, (Hanham).
4279. *Agriotes mancus* Say. Aweme, Man., May, 10, 1910, (N. Criddle).
4280. *Agriotes stabilis* Lec. Aweme, Man., May, June, (N. Criddle).
4320. *Melanotus castanipes* Payk. Husavick, Man., June 20, 1912, (N. Criddle).
* *Limonius venablesi* Wickham. Vernon, B.C., May 14, (Venables); Psyche, Vol. xx, 27.
4352. *Limonius discoideus* Lec. Vernon, B.C., (Brittain); Quamichan Lake, B.C., (Hanham).
4361. *Limonius æger* Lec. Aweme, Man., May 4, 1909, (N. Criddle).
4394. *Athous nigripilis* Mots. Victoria, B.C., Quamichan Lake, B.C., (Hanham).
4412. *Ostodes tenuicollis* Rand. Aweme, Man., July 20, 1910, (N. Criddle).
Corymbites sjælandicus Mull. Aweme, Man., June 19, 1909, (E. Criddle).
4427. *Corymbites vernalis* Hentz. Oak Bay, Victoria, B.C., one under bark of fallen oak tree, no other record for Brit. Col., (Hanham).
4450. *Corymbites tarsalus* Melsh. Victoria, B.C., new to my Brit. Col. list, (Hanham).
4451. *Corymbites caricinus* Germ. Aweme, Man., May, June, (N. Criddle).
4471. *Corymbites fraternus* Lec. Goldstream, B.C., (Hanham).
4480. *Corymbites propola* Lec. Aweme, Man., June, July, (N. Criddle).
4490. *Corymbites conjungens* Lec. Vernon, B.C., (Brittain).
4587. *Dicerca sexualis* Cr. Quamichan Lake, B.C., May 21, my first capture of this species (Hanham).
4592. *Trachykele blondeli* Mars. Goldstream, B.C., June 22, 1901, (Hanham).
4623. *Melanophila gentilis* Lec. Quamichan Lake, B.C., April 20, (Hanham).
(10076) *Chrysobothris caurina* Horn. Quamichan Lake, B.C., (Hanham).
4791. *Eros trilineatus* Melsh. Meach Lake, Que., July 6, (Bro. Germain).
4882. *Podabrus basilaris* Say. Ottawa, June; Wakefield, Que., July 1, (Bro. Germain).
4935. *Telephorus nigritulus* Lec. Ottawa, June, (Bro. Germain).
5245. *Eucrada humeralis* Melsh. Ottawa, June 21, (Beaulne); Mr. Harrington has also taken this species under beech bark.
5350. *Bostrychus bicornus* Web. Aylmer, Que., June 18, (Bro. Germain); Hull, Que., June 9, (Harrington).
5356. *Amphicerus bicaudatus* Say. Ottawa, May 4, (Bro. Germain).
* *Aphodius columbiensis* Wick. Vernon, B.C., (Venables); Psyche, Vol. xx, 27.
5983. *Opsimus quadrilineatus* Mann. Quamichan Lake, B.C., (Hanham).

6094. *Hybodera tuberculata* Lec. Quamichan Lake, B.C., (Hanham).
6099. *Molorchus longicollis* Lec. Victoria, B.C., (Hanham).
6189. *Xylotrechus planifrons* Lec. Vernon, B.C., (Brittain); Quamichan Lake, B.C., (Hanham).
6219. *Atimia dorsalis* Lec. Duncan, B.C., (Hanham).
6229. *Prototrichus vitticollis* Lec. Quamichan Lake, B.C., at bloom, May, (Hanham).
6230. *Leptalia macilenta* Mann. Quamichan Lake, B.C.; Victoria, B.C., (Hanham).
6238. *Toxotus schaumii* Lec. Winnipeg, Man., June 26, (Hanham).
6239. *Toxotus flavolineatus* Lec. Goldstream, B.C.; Maple Bay, B.C.; July, (Hanham).
6241. *Toxotus virgatus* Lec. Winnipeg, Man., June 26, (Hanham).
6560. *Leptura valida* Lec. Quamichan Lake, B.C., June, (Hanham).
* *Evodinus vancouveri* Csy. "Vancouver Island"; Memoirs on the Coleoptera, IV., Nov. 30, 1913, by Thos. L. Casey.
* *Brachyleptura cuneatula* Csy. "Ontario"; Memoirs on the Coleoptera, IV., Nov. 30, 1913, by Thos. L. Casey.
* *Strangalepta keeni* Csy. Inverness, B.C., (Keen); Memoirs on the Coleoptera, IV., Nov. 30, 1913, by Thos. L. Casey.
* *Xestoleptura columbica* Csy. "British Columbia" (Keen); Memoirs on the Coleoptera, IV., Nov. 30, 1913, by Thos. L. Casey.
* *Xestoleptura vancouveri* Csy. "Vancouver Island"; Memoirs on the Coleoptera, IV., Nov. 30, 1913, by Thos. L. Casey.
6403. *Synaphoeta guexi* Lec. Victoria, B.C., July 17, (Blackmore).
6471. *Ataxia crypta* Say. Winnipeg, Man., June, July, (Hanham).
6484. *Saperda discoidea* Fab. Hull, Que., June 21, 1912, (Kitto).
6498. *Oberea schaumii* Lec. Winnipeg, Man., (Hanham).
6543. *Donacia pusilla* Say. Quamichan Lake, B.C., (Hanham).
(10337) *Syneta hamata* Horn. Cameron Lake, B.C., June 27, (Hanham).
6556. *Zengophora consanguinea* Cr. Ottawa, July 9, 1912 (Bro. Germain).
6590. *Coscinoptera dominicana* Fab. Brandon, Man.; the larvæ were taken from around nest of large red ant, alongside of railway track on April 23, and the first beetles made their appearance on May 17, (Hanham).
6804. *Chrysomela præcelsis* Rog. Birds Hill, (near Winnipeg) Man., July 1, 1899, (Hanham).
6864. *Luperus varipes* Lec. Vernon, B.C., (Brittain).
7067. *Microrhopala excavata* Oliv. Ottawa, July 9, 1912, (Bro. Germain).
7553. *Helops regulosus* Lec. Vernon, B.C., (Brittain).
7579. *Strongylium tenuicolle* Say. Montreal, Que., July 29, (Bro. Germain).
Xanthochroa testacea Horn. Quamichan Lake, B.C., end July and August, (Hanham).
7746. *Oxacis bicolor* Lec. Quamichan Lake, B.C., Aug., (Hanham).
7759. *Cephaloon tenuicorne* Lec. Cowichan Lake, B.C., June 18, (Hanham).
7777. *Mordella quadripunctata* Say. Husavick, Man., July 11, 1910, (Wallis).
7779. *Mordella melæna* Germ. Husavick, Man., July 11, 1910, (Wallis).
7783. *Mordella marginata* Melsh. Husavick, Man., July 11, 1910, (Wallis).
8002. *Meloe montanus* Lec. Quamichan Lake, B.C., (Hanham).
8011. *Meloe strigulosus* Mann. Quamichan Lake, B.C., (Hanham).

8258. *Anametis grisea* Horn. Winnipeg, Man., on *Eleagnus argentea,* (Wallis).
* *Dyslobus bituberculatus* Pierce. "North Bend, B.C.," June 6, 7, (Hubbard and Schwarz collection); Proc. U. S. N. M., Vol. 45, 388.
* *Panscopus* (*Nomidus*) *ovalis* Pierce. Banff, Alta., June 10, (Hubbard and Schwarz); Proc. U. S. N. M., Vol. 45, 396.
8358. *Trichalophus planirostris* Lec. Winnipeg, Man., May 20, 1911, (Wallis).
8482. *Hypomolyx pinicola* Coup. Onah, Man., May 24, 1912, (Wallis).
8526. *Cleonus vittatus* Kirby. Victoria, B.C., July 4, 1912, (Wallis).
8530. *Dorytomus laticollis* Lec. Winnipeg, Man., Sept. 21, 1911, (Wallis).
8536. *Dorytomus squamosus* Lec. Aweme, Man., June 3, 10, 1902, (N. Criddle).
8575. *Endalus ovalis* Lec. Selkirk, Man., June 10, 1911, (Wallis).
8578. *Anchodemus-angustus* Lec. Husavick, Man., July 11, 1910, (Wallis) .
* *Magdalis austera* Fall. Ridgeway, Ont., (A. H. Kilman); Toronto, Ont.; Trans. Amer. Ent. Soc. Vol. xxxix, 29.
8615. *Magdalis barbita* Say. Aweme, Man., July 1, (E. Criddle).
8616. *Magdalis aenescens* Lec. Vernon, B.C., (Brittain).
8644. *Anthonomus musculus* Say. Aweme, Man., on *Elæagnus argentea,* June 2, (E. Criddle).
8660. *Anthonomus elongatus* Lec. Aweme, Man., June 13, 1907, (N. Criddle).
8697. *Tychius tectus* Lec. Aweme, Man., July 4, 1903, (N. Criddle).
8787. *Cryptorhynchus bisignatus* Say. Onah, Man., May 24, 1912, (Wallis).
8808. *Piazurus californicus* Lec. Peachland, B.C., July 15, 1912, (Wallis).
Balaninus pardalis Chit. Aweme, Man., June 31, 1904, reared from acorns of *Quercus macrocarpa,* (N. Criddle).

Diptera.

(Arranged according to a catalogue of North American Diptera, by J. M. Aldrich, Smithsonian Misc. Coll. XLVI., No. 1,444. The numbers refer to the pages in the catalogue).

A good deal of material in this order has been studied and determined by specialists during the year. Dr. Dietz has continued to name collections of Tipulidæ, as has also Mr. C. P. Alexander. Many of the species determined are well known, but the records are of interest to us and add to our knowledge of the distribution.

78. *Rhipidia maculata* Meig. Truro, N.S., July 26, (R. Matheson).
79. *Dicranomyia hæretica* O. S. Truro, N.S., July 13, (R. Matheson).
79. *Dicranomyia halterata* O. S. Ottawa, June 13, (Beaulne); Truro, N.S., July 7, (R. Matheson).
79. *Dicranomyia immodesta* O.S. Truro, N.S., July 13 (R. Matheson).
79. *Dicranomyia liberta* O. S. Truro, N.S., July 26; Debert, N.S., June 21, (R. Matheson).
79. *Dicranomyia longipennis* Schum. Aweme, Man., June 13, (E. Criddle).
81. *Limnobia solitaria* O. S. Truro, N.S., July 12, (R. Matheson).
83. *Antocha opalizans* O. S. Coaticook, Que., Sept. 6, (Beaulne); Truro, N.S., July 7, 26, (R. Matheson).
83. *Cryptolabis paradoxa* O. S. Truro, N.S., July 7, 12, (R. Matheson).
84. *Erioptera armata* O. S. Truro, N.S., July 7, (R. Matheson).

84. *Erioptera armillaris* O. S. Truro, N.S., July 12, (R. Matheson).
84. *Erioptera caloptera* Say. Truro, N.S., July 7, (R. Matheson).
84. *Erioptera chlorophylla* O. S. Truro, N.S., July 7-12, (R. Matheson).
85. *Erioptera septentrionalis* O. S. Aweme, Man., June 16, (E. Criddle); Truro, N.S., July 26, (R. Matheson).
85. *Erioptera venusta* O. S. Coaticook, Que., Sept. 6, (Beaulne).
85. *Goniomyia cognatella* O. S. Aweme, Man., June 28, (E. Criddle); Truro, N.S., July 7, 12, 26, (R. Mathesòn).
86. *Goniomyia subcinerea* O. S. Coaticook, Que., Sept. 6, (Beaulne).
86. *Goniomyia sulphurella* O. S. Truro, N.S., July 7, 12, (R. Matheson).
Rhabdomastix flava Alex. Truro, N.S., July 12, 26, (R. Matheson).
88. *Trichocera bimacula* Walk. Ottawa, Aug., 5, 1901, (Gibson).
89. *Epiphragma fascipennis* Say. Aweme, Man., June 12-26, (E. Criddle).
89. *Limnophila adusta* O. S. Ottawa, July 4, (Beaulue); Truro, N.S., July 7, 26, (R. Matheson).
89. *Limnophila contempta* O. S. Aweme, Man., June 26, (E. Criddle); Coaticook, Que., Sept. 6, (Beaulne).
90. *Limnophila imbecilla* O. S. Aylmer, Que., June 29, (Beaulne).
90. *Limnophila inornata* O. S. Aweme, Man., June 25, (E. Criddle).
90. *Limnophila macrocera* Say. Truro, N.S., July 12, (R. Matheson).
Limnophila noveboracensis Alex. Truro, N.S., July 13, (R. Matheson).
90. *Limnophila recondita* O. S. Truro, N.S., July 13, (R. Matheson).
90. *Limnophila rufibasis* O. S. Ottawa, June 18; Aylmer, Que., June 15, (Beaulne); Aweme, Man., June 16, (E. Criddle).
90. *Limnophila tenuipes* Say. Ottawa, Sept. 9, 1900, (Gibson).
91. *Limnophila ultima* O. S. Banff, Alta., (Sanson).
92. *Eriocera longicornis* Walk. Little Current River, July 8, 1903; Nagagami River, June 20, 1903; Mamamattawa River, (Hudson Bay Slope), June 21, 1903, (W. J. Wilson).
92. *Eriocera spinosus* O. S. Truro, N.S., larva, May 19, (R. Matheson).
93. *Amalopsis calcar* O. S. Meach Lake, Que., Sept. 2, 1903, (J. Fletcher); Rostrevor, Ont., Sept. 21, 1903, (Gibson).
93. *Amalopsis inconstans* O. S. Ottawa, June 9, 1900, (Gibson); Aweme, Man., June-July (E. Criddle); Aylmer, Que., June 15, (Beaulne); Truro, N.S., July 7, (R. Matheson).
93. *Amalopsis vernalis* O. S. Truro, N.S., July 12, (R. Matheson).
94. *Pedicia albivitta* Walk. Londonderry, N.S., (Faribault).
94. *Liogma nodicornis* O. S. Aweme, Man., June 16-25, (E. Criddle).
95. *Bittacomorpha clavipes* Fab. Ottawa, Sept. 12, 1908, (J. A. Letourneau); Aug. 27, 1911 (Gibson); Massett, Q.C.I., Br. Col., (Keen); Truro, N.S., May 24, (R. Matheson)
Oropeza albipes John. Aweme, Man., June, (E. Criddle).
Oropeza sayi John. Aweme, Man., June 23, (E. Criddle).
97. *Ctenophora angustipennis* Loew. Aweme, Man., June 25, (E. Criddle); Duncan, B.C., April 24, 1904, (Hanham).
97. *Pachyrhina eucera* Loew. Truro, N.S., July 7, (R, Matheson).
98. *Pachyrhina ferruginea* Fab. Prince Albert, Sask., July 27, (J. Fletcher); Truro, N.S., July 12, 26, (R. Matheson).
98. *Pachyrhina incurva* Loew. Aweme, Man., July 7, (E. Criddle); Aylmer, Que., June 29, (Beaulne); Ottawa, June 15, 1906, (J. Fletcher); Truro, N.S., July 26, (R. Matheson).

98. *Pachyrhina occipitalis* Loew. Coaticook, Que., Sept. 8, (Beaulne).
98. *Pachyrhina pedunculata* Loew. Ottawa, July 4, (Beaulne); Ottawa, June 28, 1906, (Gibson); Truro, N.S., July 13, (R. Matheson).
98. *Pachyrhina sodalis* Loew. Aweme, Man., June 25, (E. Criddle).
99. *Pachyrhina tenuis* Loew. Ottawa, June 18, (Beaulne); Truro, N.S., July 7, (R. Matheson).
100. *Tipula abdominalis* Say. Truro, N.S., July 7, Aug. 7, (R. Matheson).
100. *Tipula angulata* Loew. Aylmer, Que., June 24, (Beaulne).
100. *Tipula angustipennis* Loew. Chelsea, Que., May 30, 1908, (J. Fletcher); Kalso, B.C., May 24, (Cockle); Banff, Alta., (Sanson).
100. *Tipula apicalis* Loew. Ottawa, July 4, (Beaulne); Truro, N.S., July 7, (R. Matheson).
101. *Tipula bicornis* Loew.MS. Ottawa, June 18, (Beaulne).
101. *Tipula caloptera* Loew. Middleton, N.S., May 27, 1911, (Coll. unknown); Truro, N.S., July 12, 13, (R. Matheson).
102. *Tipula fasciata* Loew. Truro, N.S., July 12, (R. Matheson).
102. *Tipula grata* Loew. Aylmer, Que., June 24; Ottawa, July 11, (Beaulne).
102. *Tipula hebes* Loew. Truro, N.S., July 12-26, (R. Matheson).
103. *Tipula macrolabis* Loew. Aylmer, Que., June 24, (Beaulne); Aweme, Man., June 25, (E. Criddle).
103. *Tipula megaura* Doane. Ottawa, June 28; Aylmer, Que., June 29, (Beaulne).
103. *Tipula platymera* Walk. Banff, Alta., (Sanson).
104. *Tipula tephrocephala* Loew. Aweme, Man., June 31, (E. Criddle); Ottawa, June 19; Aylmer, Que., June 15, (Beaulne).
104. *Tipula tessellata* Loew. Banff, Alta., (Sanson).
104. *Tipula trivittata* Say. Truro, N.S., July 7, (R. Matheson).
105. *Tipula valida* Loew. Aylmer, Que., June 15; Ottawa, June 18, (Beaulne).
126. *Theobaldia incidens* Thom. Old Crow River, Y.T., June 1, 1912, (J. M. Jessup).
149. *Sciara coprophila* Lint. St. Catharines, Ont. (W. A. McCubbin).
* *Cystiphora canadensis* Felt. Toronto, Ont., reared July 10, (Cosens); Can. Ent. XLV., 417.
166. *Bibio femoratus* Wied. Montreal, Que., Aug. 16, 1906, (Beaulieu).
169. *Simulium hirtipes* Fries. St. Hilaire, Que., May 24, 1906, (Beaulieu).
170. *Simulium pictipes* Hagen. Ottawa, July 30, 1912, (Beaulieu).
170. *Simulium venustum* Say. Rampart House, Y.T., Aug. 20-29; Old Crow River, Y.T., Aug. 20-23, 1912; Long. 141, Lat. 69-10, Aug. 14-17, 1912, (J. M. Jessup).
174. *Allognosta obscuriventris* Loew. Ottawa, July 2, 1912, (Beaulieu).
182. *Stratiomyia apicula* Loew. Aweme, Man., June and August, 1912, (N. Criddle).
188. *Euparyphus limbocutris* Will. Aweme, Man., July 11, 1911, (E. Criddle).
189. *Euparyphus tetraspilus* Loew. Aweme, Man., July 11, 1911. (E. Criddle).
189. *Nemotelus canadensis* Loew. Aweme, Man., June 15, 1911, (E. Criddle).
190. *Nemotelus glaber* Loew. Ottawa, July 2, 1912, (Beaulieu).
196. *Chrysops frigidus* O. S. Youghall, N.B., July 3, 1908, (Gibson).
196. *Chrysops indus* O. S. Mer Bleue, Carlsbad Springs, Ont., June 20, 1908, (Gibson).
197. *Chrysops niger* Macq. Shelburne, N.S., July 1, 1911, (Gibson).

198. *Chrysops vittatus* Wied. Rostrevor, Ont., Sept., 3, 1907, (Gibson).
200. *Tabanus affinis* Kirby. Weymouth, N.S., June 8, 1911, (Sanders).
203. *Tabanus epistates* O. S. Shelburne, N.S., July 1, 1911, (Gibson).
205. *Tabanus microcephalus* O. S. Shelburne, N.S., July 11, 1911; Rostrevor, Ont., Sept. 15, 1907, (Gibson).
Tabanus osborni Hine. Firth, Y. T., (Long. 141, Lat. 68-41-33), June 27-July 9, 1912; Shore of Arctic Ocean, Long. 141, (Lat. 69-40), July 27-30, 1912; Old Crow River, Y.T., Aug. 20-23, 1912, (J. M. Jessup).
207. *Tabanus septentrionalis* Loew. Youghall, N.B., July 2, 1908, (Gibson).
208. *Tabanus thoracicus* Hine. Mer Bleue, Carlsbad Springs Ont., June 1, 1903, (Gibson).
209. *Tabanus zonalis* Kirby. Shelburne, N.S., July 1, 1911, (Gibson); Aweme, Man., June, 1910, (N. Criddle).
* *Arthropeas magna* John. Beulah, Man., Can. Ent. XLV, 12.
219. *Oncodes incultus* O. S. Aweme, Man., July 5, 1911, (N. Criddle).
220. *Oncodes melampus* Loew. Long. 141, Lat. 69 to 69-20, July 12-20, 1912. (J. M. Jessup).
220. *Oncodes pallidipennis* Loew. Aweme, Man., June 15. (N. Criddle).
228. *Anthrax alternata* Say. Aweme, Man., Aug. 23, 1908, (N. Criddle).
232. *Anthrax lateralis* Say. Aweme, Man., Aug. 4, 1909, (N. Criddle).
232. *Anthrax morio* Linné. Aweme, Man., June 18, 1909, (N. Criddle).
234. *Anthrax sinuosa* Wied. Aweme, Man., July-Aug., 1909, (N. Criddle).
236. *Bombylius pygmæus* Fab. Aweme, Man., May, June, 1909, (N. Criddle).
238. *Systoechus vulgaris* Loew. Aweme, Man., July 12, 1909, (N. Criddle).
259. *Cyrtopogon dasylloides* Will. Rampart House, Y.T., Aug. 20-29, 1912, (J. M. Jessup).
262. *Holopogon seniculus* Loew. Aweme, Man., June 17, 1911, (E. Criddle).
* *Neurigona arcuata* Van Duzee. Kearney, Ont., July 3, 1909, (M. C. Van Duzee); Annals Ent. Soc. Amer. VI, March, 1913.
* *Neurigona bivittata* Van Duzee. Bear Lake, B.C., July 20, 1903, (R. P. Currie); Annals Ent. Soc. Amer. VI, March, 1913.
* *Neurigona deformis* Van Duzee. Kearney, Ont., July 8, (M. C. Van Duzee); Annals Ent. Soc. Amer. VI, March, 1913.
* *Neurigona disjuncta* Van Duzee. Toronto; Ridgeway, Ont., (M. C. Van Duzee); Annals Ent. Soc. Amer. VI, March, 1913.
* *Neurigona maculata* Van Duzee. Toronto; Kearney, Ont., (M. C. Van Duzee); Annals Ent. Soc. Amer. VI, March, 1913.
294. *Neurigona carbonifera* Loew. Rigaud, Que., June 25, 1906, (Beaulieu).
328. *Iteaphila macquarti* Zett. Rampart House, Y.T., (D. H. Nelles). A very northern record.
334. *Dorniphora concinna* Mg. Montreal, Que., June 10, 1906, (Beaulieu).
335. *Hypocera femorata* Mg. Montreal, Que., Aug. 24, 1906, (Beaulieu).
337. *Aphiochæta rufipes* Mg. Montreal, Que., April 15, 1906, (Beaulieu).
338. *Trineura aterrima* Fab. Rampart House, Y.T., Aug. 20-29, 1912, (J. M. Jessup).
Pipunculus discolor Banks. Montreal, Que., July 18, 1908, (Beaulieu).
Chilosia variabilis Panz. Firth, Y.T., (Long. 141, Lat. 68-41-33), June 27-July 9, 1912, (J. M. Jessup). Prof. J. M. Aldrich, who determined the species, states that this European insect has not heretofore been noted from the North American continent, (A. G.).

354. *Baccha aurinota* Walk. Aweme, Man., June 16, 1911, (E. Criddle).
364. *Syrphus arcuatus* Fall. Old Crow River, Y.T., Aug. 20-23, 1912, (J. M. Jessup).
365. *Syrphus contumax* O. S. Long. 141, Lat. 69 to 69-20, July 12-20, 1912, (J. M. Jessup).
367. *Syrphus ribesii* L. Old Crow River, Y.T., Aug. 20-23, 1912, (J. M. Jessup).

Volucella bombylans L. Long. 141, Lat. 69 to 69-20, July 12, 1912, (J. M. Jessup). Prof. Aldrich, who made the determination, states that this species has not heretofore been noted from North America. He further adds: "Williston noted that *Volucella erecta* Walk. is hardly distinct from *bombylans,* and I presume it is properly to be considered only a variety." (A. G.).

388. *Eristalis pilosus* Loew. Long. 141, Lat. 69 to 69-20, July 12-20, 1912, (J. M. Jessup).
389. *Eristalis temporalis* Thoms. Rampart House, Y.T., Aug. 20-29, 1912, (J. M. Jessup).
412. *Oncomyia abbreviata* Loew. Aweme, Man., July 11, 1911, (E. Criddle).
444. *Siphona geniculata* DeG. Montreal, Que., May 20, 1906, (Beaulieu).
453. *Panzeria radicum* Fab. Long. 141, Lat. 69 to 69-20, July 12-20, 1912, (J. M. Jessup).
458. *Exorista ordinaria* Van der Wulp. Ottawa, Aug. 25, 1912, (Beaulieu).
478. *Gonia capitata* DeG. Between White Horse and Yukon Crossing, May 15-20, 1912, (J. M. Jessup).
488. *Echinomyia florum* Walk. Long. 141, Lat. 69-10, Aug. 14-7, 1912, (J. M. Jessup).
512. *Sarcophaga helicis* Town. Montreal, Que., May 20, 1906, (Beaulieu).

Ernoneura argus Zett. Shore of Arctic Ocean, Long. 141, (Lat. 69-40), July 27-30, 1912, (J. M. Jessup). Prof. Aldrich informs me that this European species has not heretofore been recorded from North America; it is an Arctic form in Europe, (A. G.).

518. *Cynomyia cadaverina* Desv. Old Crow River, Y.T., June 18-20, 1912; Long. 141, Lat. 69 to 69-20, July 12-20, (J. M. Jessup).
519. *Calliphora erythrocephala* Mg. Long. 141, Lat. 69-20, Aug. 4-8, 1912, (J. M. Jessup).
521. *Lucilia cæsar* L. Rampart House, Y.T., Aug. 20-29, 1912, (J. M. Jessup).
522. *Lucilia sericata* Mg. Rampart House, Y.T., Aug. 20-29, 1912, (J. M. Jessup).
523. *Phormia terræ-novæ* Desv. Old Crow River, Y.T., June 18-20; Rampart House, Y.T., Aug. 20-29, 1912, (J. M. Jessup).
525. *Pyrellia cyanicolor* Zett. Old Crow River, Y.T., June, 18-20, 1912, (J. M. Jessup).

* *Fannia tibialis* Malloch. Kaslo, B.C., June 9, 15, 1903, (R. P. Currie); Proc. U. S. N. M., Vol. 44, 461.

* *Fannia æthiops* Malloch. Ainsworth, B.C., (R. P. Currie); Proc. U. S. N. M., Vol. 44, 628.

Fannia incisuralis Zett. Montreal, Que., Aug. 21, 1906, (Beaulieu).

* *Paralimnophora brunnesquama* Malloch. Ottawa; Montreal; St. John, N.B., (W. McIntosh); Proc. U. S. N. M., Vol. 45, 605.

* *Anthomyia bidentata* Malloch. Kalso, B.C., (R. P. Currie); Proc. U. S. N. M., Vol. 45, 606.

* *Trixoscelis fumipennis* Melander. Aweme, Man., June 12, 1911, (N. Criddle); Psyche, XX., 168.

575. *Limosina crassimana* Haliday. Montreal, Que., June 17, 1906; Ottawa, July 20, 1912, (Beaulieu).

575. *Limosina frontinalis* Fallen. Montreal, Que., July 7, 1906, (Beaulieu).

* *Borborus arcticus* Malloch. Fortchimo, Ungava Bay, Labrador, (L. M. Turner); Proc. U. S. N. M., Vol. 44, 367.

576. *Borborus geniculatus* Macq. Ottawa, July 20, 1912, (Beaulieu).

581. *Sepedon armipes* Loew. Aweme, Man., June-July, (E. Criddle).

586. *Sapromyza rotundicornis* Loew. Rampart House, Y.T., Aug. 20-29, 1912, (J. M. Jessup).

617. *Calobata pallipes* Say. Aweme, Man., June-July, (E. Criddle).

629. *Parydra quadrituberculata* Loew. Ottawa, July 26, 1912, (Beaulieu).

633. *Chlorops assimilis* Macq. Ottawa, July 2, 1912, (Beaulieu).

635. *Eurina exilis* Coq. Aweme, Man., June 17, 1911, (E. Criddle).

638. *Oscinis coxendix* Fitch. Montreal, Que., July 16, 1906; Ottawa, July 2, 1912, (Beaulieu).

644. *Diastata vagans* Loew. Montreal, Que., (Beaulieu).

* *Agromyza longispinosa* Malloch. Bear Lake, B.C., July 20, 1903; Kalso, B.C., July 18, 1903, (R. P. Currie); Kalso, B.C., July 7, 1903, (A. N. Caudell); Annals Ent. Soc. Amer., Vol. VI, Sept. 1913.

* *Agromyza canadensis* Malloch. Cottage Beaulieu, Montreal, Que., (not Ottawa, Can., as in Mr. Malloch's paper), Aug. 14, (Beaulieu); Annals Ent. Soc. Amer., Vol. VI, Sept. 1913.

* *Agromyza dubitata* Malloch. Montreal, Que., (not Cottage Beaulieu and Isle de Montreal, Ottawa, as in Mr. Malloch's paper), June and July, 1906, (Beaulieu); Annals Ent. Soc. Amer., Vol. VI, Sept., 1913.

647. *Agromyza æneiventris* Fallen. Ottawa, July 2, 1912; Montreal, Que., July 16, 1906, (Beaulieu).

648. *Agromyza lateralis* Will. Montreal, Que., June 3, 1906, (Beaulieu).

648. *Agromyza neptis* Loew. Montreal, Que., July 7, 1906, (Beaulieu).

Agromyza scutellata Fallen. Montreal, Que., July 7, 1906, (Beaulieu).

649. *Agromyza terminalis* Coq. Montreal, Que., Aug. 18, 1906, (Beaulieu).

649. *Desmometopa m-nigrum* Zett. Montreal, Que., July 7, 1906, (Beaulieu).

651. *Milichia indecora* Loew. Montreal, Que., July 10, 1905; Rigaud, Que., June 25, 1906, (Beaulieu).

Tethina rostrata Hendel. Prof. Aldrich informs me that this species, which was described in Wiener Entomologische Zeitung, XXX., 41, 1911, was collected by him on Pender Island, B.C., not at Pender, Idaho, as stated in the journal quoted, (A. G.).

* *Phytomyza major* Malloch. Ungava Bay, Laborador, (L. M. Turner); Proc. U. S. N. M., Vol. 46, 150.

652. *Ochtriphila polystigma* Meig. Ottawa, July 2, 1912, (Beaulieu).

Hymenoptera.

During 1913, Mr. F. W. L. Sladen, of the Division of Entomology, has studied several collections of aculeate hymenoptera, from various parts of Canada. In the Ottawa district large collections have been made by Mr. Sladen, throughout the season. Many of these have been definitely determined and records are given below. We are specially grateful to Dr. S. Grænicher, of the City Museum, Milwaukee, Wis., for determining many of the Apoidea. Some, it will be seen, are not of uncommon occurrence, but little has been published regarding species occurring in eastern Ontario.

Megarhyssa greenei Vier. Preston, Ont., (H. Groh).

* *Exochilum neglectum* Morley. "Four pairs including the type were taken about Hudson's Bay, in 1844, except a single male found by Redman in Nova Scotia, about the same time"; Revision of the Ichneumonidæ, Part II, by C. Morley, (British Museum) p. 76.

* *Exochilum verticale* Morley. "Taken about 1844 in the district of Hudson's Bay, by George Barnston"; Revision of the Ichneumonidæ, Part II, by C. Morley, (British Museum), p. 78.

* *Microdus ocellanæ* Richardson. Kentville, N.S., July 28, 1912, (Sanders); Can. Ent. Vol. XLV, 212.

* *Xyela dissimilis* Rohwer. Banff, Alta., (Sanson); Proc. U. S. N. M., Vol. 45, 270.

* *Cœlinidea ferruginea* Gahan. Ottawa, July 21, 1899 (J. Fletcher); Proc. U. S. N. M., Vol. 46, 434.

Lasius brevicornis Em. Arnprior, Ont., Aug. 4, (Hewitt).

Aphænogaster fulva Rog. var. *picea* Em. Arnprior, Ont., Aug. 4, (Hewitt).

* *Formica bradleyi* Wheeler. Medicine Hat, Alta., (J. C. Bradley); Bull. Mus. Comp. Zoology, Vol. LIII, No. 10, 423.

Formica fusca L., var. *subænescens* Em. Arnprior, Ont., Aug. 4, (Hewitt).

Formica neogagates Em. Anprior, Ont., Aug. 4, (Hewitt).

Formica sanguinea Latr., sub. sp. *rubicunda* Em. Arnprior, Ont., Aug. 4, (Hewitt).

Vespa carolina Drury. Point Pelee, Ont., May 31, (P. A. Taverner).

Chlorion harrisi H. Fernald. Chatham, Ont., Aug. 24, (Sladen).

Cerceris fulvipes Cr. Ottawa, Aug., (Sladen).

Crabro aciculatus Prov. Montreal, June 22, 1906, (Beaulieu); Ottawa, July 4, (S. N. Lord).

Colletes lacustris Swenk. Ottawa, June 11 to July 7, at flowers of *Rubus*, (Sladen).

Colletes armatus Patton. Ottawa; Hull; Kazabazua, Que., Aug. 9 to Sept. 5, (Sladen).

Colletes brevicornis Robt. Aweme, Man., June 23, (Criddle).

Colletes inæqualis Say. Ottawa, April 24, 1911, (Beaulne).

Colletes gilensis Ckll. Similkameen, Okanagan, B.C., Sept. 11, 1913, (Tom Wilson).

Sphecodes ranunculi Rob. Ottawa, May, 1911, (Beaulne).

Sphecodes dichrous Sm. Ottawa, June, Aug., (Sladen).

Sphecodes prosphorus Lov. and Ckll. Ottawa, July, Aug., (Sladen).

Sphecodes nephlelotus Lov. and Ckll. Ottawa, Sept., Oct., (Sladen).

Sphecodes levis Lev. and Ckll. Ottawa, Sept., Oct., (Sladen).

* *Sphecodes hudsoni* Ckll. Hudson Bay; Can. Ent. Vol. XLV, 13.
Halictus lerouxii Lep. Ottawa, May, July, Aug., (Sladen).
Halictus coriaceus Sm. Ottawa, June, Aug., (Sladen).
Halictus truncatus Robt. Ottawa, April, Aug., (Sladen).
Halictus provancheri D. T. Ottawa, May, July, Aug., (Sladen).
Halictus pilosus Sm. Ottawa, Aug., Sept., (Sladen).
Halictus lineatulus Crawf. Ottawa, Sept., (Sladen).
Halictus zephyrus Sm. Ottawa, May, Sept., (Sladen).
Andrena vicina Sm. Ottawa, May, (Sladen).
Andrena radiatula Ckll. Ottawa, April 23, (Sladen).
Andrena cockerelli Græn. Ottawa, April, 1911, (Beaulne).
Andrena cratægi Robt. Ottawa, June 2, (Sladen).
Andrena hippotes Robt. May 28, 1911, (Beaulne).
Andrena illinoiensis Robt. Ottawa, April 21, (Sladen).
Andrena flavoclypeata Sm. Ottawa, June 23, (Sladen).
Andrena thraspii Graen. Ottawa, June 26, (Sladen).
Andrena robertsonii D. T. Ottawa, June 23, (Sladen).
Andrena nubecula Sm. Ottawa, Aug. 13, (Sladen).
Andrena nivalis Sm. Ottawa, June 18, (Sladen).
Andrena hirticincta Prov. Ottawa, Aug. 13, (Sladen).
Andrena canadensis D.T. Ottawa, Aug. 12, (Sladen).
Perdita octomaculata Say. Ottawa, Aug. 15, 1912, (Beaulne).
Calliopsis andreniformis Sm. Ottawa, June to Oct., (Sladen).
Melissodes aurigenia Cr. Thompson River. B.C., August 13, on "wild sunflower" (Tom Wilson); Ottawa, July 15 to Aug. 8, on *Rudbeckia* and *Coreopsis;* Guelph, Ont., Aug. 27, (Sladen).
Melissodes obliqua Say. Chatham, Ont., Aug. 22, (Sladen).
Melissodes cnici Robt. Ottawa, July 11 to Aug. 8, on Canada Thistle, (Sladen).
Ceratina dupla Say. Ottawa, June to Sept., (Sladen).
Xylocopa virginica Dru. St. Catharines, Ont., June 3, (G. J. Spencer).
Megachile wootoni Ckll. Ottawa, June, 1912, (Beaulne); June, July, (Sladen).
Megachile latimanus, Say. Ottawa, July, Aug., (Sladen).
Megachile pugnata Say. Ottawa, Aug. 20, 1912, (Beaulne); June-August, (Sladen).
Megachile infragilis Cr. Ottawa, June to Sept., (Sladen).
Megachile vidua Sm. Hull, Que., Aug. 31, (Hewitt); Montreal, Que., (A. Willey).
Megachile generosa Cr. Ottawa, June-Aug., (Sladen).
Megachile brevis Say. Ottawa, June-Aug., (Sladen).
Cœlioxys ribis Ckll. Ottawa, July, (Sladen).
Cœlioxys alternata Say. Ottawa, July, (Sladen).
Cœlioxys lucrosa Cr. Ottawa, June 14, (Sladen); Montreal, Que., (A. Willey).
Cœlioxys octodentata Say. Ottawa, June 27, (Sladen).
Cœlioxys rufitarsus Sm. Ottawa, July-Oct., (Sladen).
Osmia atriventris Cr. Ottawa, April 25 to June 5, (Sladen).
Osmia canadensis Cr. Ottawa, May 4 to June 5, (Sladen).
Heriades carinatus Cr. Ottawa, June 28 to July 31, (Sladen).

* *Heriades leavitti* Craw. Nerepis, N.B., Aug. 22, (Leavitt); Can. Ent. Vol. XLV, 270.

* *Anthidium wallisi* Ckll. Peachland, B C., Aug. 9, 1909, (Wallis); Can. Ent. Vol. XLV, 14.

Alcidamea simplex Cr. Ottawa, June 3 to July 13, (Sladen).

Andronicus cylindricus Cr. Ottawa, June 5 to Aug. 4, (Sladen).

Clisodon terminalis Cr. Ottawa, June 6 to Aug. 18, (Sladen).

Anthophora bomboides Kirby. Ottawa, June 28; Kazabazua, Que., July, (Sladen).

Bombus morrisoni Cr. Ashcroft, B.C., (Rev. W. M. Roger).

Bombus terrestris, var. *moderatus* Cr. Rampart, Y.T., (D. H. Nelles).

Bombus separatus Cr. Aweme, Man., June 1, (Gibson); Ottawa, June 12; Chatham, Harrisburg, Guelph, Ont., Aug. 27, (Sladen).

Bombus bimaculatus Cr. Grimsby, Ont., Aug. 29, (Sladen).

* *Bombus bolsteri* Franklin. Bay of Islands, Little River, Humber River, near Deer Lake, Newfoundland, (P. G. Bolster); Trans. Amer. Ent. Soc. Vol. XXXVIII, 357.

Psithyrus insularis Sm. Ottawa, June 4-18, (Sladen), only record we have from Ontario.

Hemiptera.

A small number only of insects of this order have been received during the year, and as far as we know no systematic collections have been made in any part of Canada. Small lots of specimens collected in other years have been determined, and of these, records of the following seem worthy of inclusion here.

Scolops sulcipes Say. Winnipeg, Man., Aug. 8, 1908, (Hanham); Covey Hill, Que., Sept. 10, 1912, (Petch).

Heliria scalaris Fairm. Laval Co., Que., (Beaulieu).

Ophiderma salamandra Fairm. Chelsea, Que., July 3, 1909, (Gibson).

Elidiptera variegata Van D. Ottawa, Nov. 4, 1902, (J. Fletcher).

Macropsis nigricanus V. Duz. Rudy, Sask., July 19, 1907, (J. Fletcher).

Oncopsis variabilis Fitch. La Sienne River, District of Rainy River, Ont., July, 1890, (W. McInnis).

Halticus apterus Linn. Bondville, Que., July 28-Aug. 2, (Moore).

Lygus convexicollis Reut. Bondville, Que., July 28-Aug. 2, (Moore).

Phytocoris eximius Reut. Bondville, Que., July 28-Aug. 2, (Moore).

Phytocoris tibialis Reut. Bondville, Que., July 28-Aug. 2, (Moore).

Mimoceps insignis Uhler. Bondville, Que., July 28-Aug. 2, (Moore).

* *Aradus funestus* Bergoth. "Canada . . . Northern U. S., from the Atlantic to the Pacific Ocean"; Can. Ent. Vol. XLV, 4.

Corizus nigrosternum Sign. Bondville, Que., July 28-Aug. 2, (Moore).

Corizus novæ-boracensis Sign. Bondville, Que., July 28-Aug. 2, (Moore).

Alydus quinquespinosus Say. Winnipeg, Man., Aug. 16, 1900, (Hanham).

Brochymena quadripustulata Fabr. Covey Hill, Que., July 27, 1912, (Petch).

Ælia americana Dall. Winnipeg, Man., June, 1900.

Mormydea lugens Fab. Arnprior, Ont., Aug. 4, (Hewitt).

Podisus cynicus Say. Covey Hill, Que., July 29, (Petch).

Neuropteroid Insects (Except Odonata).

(Arranged according to a catalogue of the Neuropteroid Insects (except Odonata) of the United States, by Nathan Banks; American Entomological Society, 1907. The numbers refer to the pages of the catalogue).

Isoptera.

6. *Termopsis angusticollis* Hag. Departure Bay, Vanc. Is., B.C., July 6, (Walker).

Archiptera.

10. *Pteronarcys californica* Newp. Edmonton, Alta, (F. S. Carr).
13. *Isoperla bilineata* Say. Go-Home Bay, Ont., May 29, 1912, (Clemens).
* *Ephemerella bicolor* Clemens. Go-Home Bay, Ont., July 1-12, (Clemens); Can. Ent., Vol. XLV, 336.
* *Ephemerella lineata* Clemens. Go-Home Bay, Ont., June 14, 15, (Clemens); Can. Ent., Vol. XLV, 336.
* *Ephemerella lutulenta* Clemens. Go-Home Bay, Ont., May 29-June 19, (Clemens: Shawanaga Bay; Penticost Island; French River and Sturgeon Bay, Ont., (R. P. Wodehouse); Can. Ent. Vol. XLV, 335.
* *Siphlurus flexus* Clemens. Go-Home Bay, Ont., May 23-June 12, (Clemens); Can. Ent., Vol. XLV, 338.
* *Heptagenia lutea* Clemens. Go-Home Bay, Ont., emerged June 27-July 3, (Clemens); Can. Ent., Vol. XLV, 254.
* *Heptagenia rubromaculata* Clemens. Go-Home Bay, Ont., emerged June 22-July 29, (Clemens); Can. Ent. Vol. XLV, 258.
* *Heptagenia fusca* Clemens. Go-Home Bay, Ont., emerged June 23, 24, (Clemens); Can. Ent., Vol. XLV, 254.
* *Ecdyurus lucidipennis* Clemens. Go-Home Bay, Ont., emerged July 4 and 17, (Clemens); Can. Ent. Vol. XLV, 329.
* *Ecdyurus pullus* Clemens. Go-Home Bay, Ont., June 27-July 2, (Clemens); Can Ent. Vol. XLV, 330.

Neuroptera.

22. *Raphidia assimilis* Albarda. Departure Bay, Vanc. Is., July-Aug. (Walker).
22. *Raphidia oblita* Hag. Departure Bay, Vanc. Is., Aug. 8, (Walker).
23. *Climacia areolaris* Hag. Go-Home Bay, July 31, 1912, (Walker).
24. *Polystoechotes punctatus* Fab. Departure Bay, Vanc. Is., B.C., Aug. 5, (Walker).
24. *Hemerobius pacificus* Banks. Departure Bay, Vanc. Is., B.C., Aug. 13, (Walker).
27. *Chrysopa assimilis* Banks. Okanagan Landing, B.C., Aug. 17, (Walker).
27. *Chrysopa chi* Fitch. Nipigon, Ont., June 19, (Walker).
27. *Chrysopa chlorophana* Burm. Departure Bay, Vanc. Is., B.C., July 6, (Walker).
27. *Chrysopa coloradensis* Banks. Departure Bay, Vanc. Is., B.C., July 17, (Walker).
27. *Chrysopa majuscula* Banks. Departure Bay, Vanc. Is., B.C., Aug. 3, (Walker).

28. *Chrysopa ypsilon* Fitch. Nipigon, Ont., June 18; Dauphin, Man., June 22; Prince Albert, Sask., June 23; Departure Bay, Vanc. Is., B.C., (Walker).
30. *Myrmeleon immaculatum* DeG. Departure Bay, Vanc. Is., July 25-Aug. 5, (Walker).

Trichoptera.

(Determined by Dr. Nathan Banks.)

35. *Neuronia concatenata* Walk. Gray Island, Georgian Bay, Ont., June 27, 1912, (Walker); Lonely Lake, Vanc. Is., B.C., July 18, (Walker).
35. *Agrypnetes curvata* Banks. Nipigon, Aug. 6, 1910, (Walker); Banff, Alta., June 29, (Walker).
36. *Glyphotaelius hostilis* Hagen. Nipigon, Aug. 6, 1910, (Walker).
36. *Limnephilus combinatus* Walk. Lonely Lake, Vanc. Is., B.C., July 18, (Walker).
39. *Platyphylax lepida* Hag. Go-Home Bay, Sept. 7, 1912, (Walker).
39. *Parachiona parvula* Banks. Banff, Alta., June 29, (Walker).
41. *Apatania tripunctata* Banks. Sulphur Mt., Banff, Alta., June 28, (Walker).
41. *Chimarrha aterrima* Hag. Muskoka Mills, Georgian Bay, Ont., June 30, 1912, (Walker).
43. *Helicopsyche borealis* Hag. Go-Home Bay, July 31, Aug. 1, 1912, (Walker).
45. *Molanna uniophylla* Vorhies. Go-Home Bay, July 2-Sept. 3, 1912. (Walker).
45. *Leptocerus angustus* Banks. Go-Home Bay, Aug. 8, 1912 (Walker).
45. *Leptocerus recurvatus* Banks. Go-Home Bay, Aug. 12, 1912, (Walker).
45. *Triænodes flavescens* Banks. Go-Home Bay, Aug. 29, 1912, (Walker).
46. *Leptocella uwarowi* Kolen. De Grassi Pt., Ont., July 1, 1912, (Walker).
46. *Œcetina avara* Banks. Go-Home Bay, July 31-Aug. 22, 1912, (Walker).
46. *Œcetina fumosa* Banks. Go-Home Bay, Aug. 12, 1912, (Walker).
46. *Œcetina immobilis* Banks. Go-Home Bay, Aug. 1-Sept. 4, 1912, (Walker).
46. *Œcetina incerta* Walk. Go-Home Bay, July 31-Sept. 3, 1912, (Walker).
46. *Mystacides sepulchralis* Walk. Go-Home Bay, Aug. 2-12, 1912, (Walker).
47. *Hydropsyche alternans* Walk. Go-Home Bay, Aug. 20, 1912, (Walker).
47. *Hydropsyche chlorotica* Hag. Go-Home Bay, Sept. 4, 1912, (Walker).
47. *Hydropsyche slossonæ* Banks. Go-Home Bay, June 7, 1912, (Walker).

Odonata.

Lestes congener Hag. Departure Bay, Vanc. Is., B.C., July 19-Aug 10, Okanagan Landing, B.C., Aug 16, (Walker).

Lestes uncatus Hag. Prince Albert, Sask., June 23; Departure Bay, B.C., June 23-July 30, (Walker).

Nehalennia irene Hagen. Dauphin, Man., June 22; Prince Albert, Sask., June 24, (Walker).

Ischnura cervula Selys. Banff, Alta, June 29, (Walker). New to Alberta list.

Enallagma ebrium Hagen. Dauphin, Man., June 23, (Walker).

Coenagrion resolutum Selys. Prince Albert, Sask., June 24; Banff, Alta, June 29, (Walker).

Coenagrion angulatum E. Walk. Prince Albert, Sask., June 24, (Walker).

Ophiogomphus severus Hag. Prince Albert, Sask., June 26, (Walker).

Aeshna caerulea septentrionalis Burm. Banff, Alta., June 29, (Walker). New to Alberta list.

Aeshna sitchensis Hag. Banff, Alta., June 29, (Walker).

Aeshna interrupta interrupta E. Walk. Departure Bay, Vanc. Is., July 31-Aug. 12 (Walker).

Aeshna eremita Scudd. Prince Albert, Sask., July 26; Departure Bay, Vanc. Is., July 31, Aug. 10, (Walker).

Aeshna canadensis E. Walk. Prince Albert, Sask., July 26; Departure Bay, Vanc. Is., Aug. 10, 13, (Walker). New to Saskatchewan list.

Aeshna tuberculifera E. Walk. Departure Bay, B.C., Aug 10, 13, (Walker), First record west of Wisconsin.

Aeshna umbrosa E. Walk. Hughes Station, Ont., (near Cochrane), Sept. 24 (W. S. Odell). Most northerly Ontario record.

Somatochlora walshii Scudd. Dauphin, Man., June 23, (Walker). New to Manitoba list.

Somatochlora minor Calv. Prince Albert, Sask., June 26, (Walker). New to Saskatchewan list.

Dorocordulia libera Selys. Fort William, Ont., June 20, (Walker). Most northerly record.

Cordulia shurtleffi Scudd. Departure Bay, Vanc. Is., July 19, (Walker).

Sympetrum madidum Hag. Prince Albert, June 23: Departure Bay, Vanc. Is., July 30, (Walker).

Sympetrum obtrusum Hagen. Okanagan Landing, B.C., Aug. 16 (Walker). These specimens are identical with eastern *obtrusum*.

Leucorrhinia hudsonica Selys. Prince Albert, Sask., June 26 (Walker). New to Saskatchewan list.

Leucorrhinia glacialis Hagen. Prince Albert, Sask., June 26; Departure Bay, B.C., July 19, (Walker). New to Saskatchewan and B. C. lists.

Leucorrhinia proxima Calv. Departure Bay, July 19, (Walker).

Leucorrhinia borealis Hag. Dauphin, Man., June 23; Prince Albert, Sask., June 25, (Walker).

Leucorrhinia intacta Hagen. Prince Albert, (Sask.), June 25, (Walker). Most northerly record and new to Saskatchewan list.

THYSANURA.

Isotoma nigra MacG. Arnprior, Ont., on snow, Dec. 25, (C. Macnamara). Determined by Dr. Folsom.

INDEX

Forty-Fifth Annual Report

OF THE

Entomological Society

OF ONTARIO

1914

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO)

PRINTED BY ORDER OF

THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO:
Printed by L. K. CAMERON, Printer to the King's Most Excellent Majesty
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WILLIAM BRIGGS
29-37 Richmond Street West
TORONTO

To His Honour JOHN STRATHEARN HENDRIE, C.V.O., a Lieutenant-Colonel in the Militia of Canada, etc., etc., etc.,

Lieutenant-Governor of the Province of Ontario.

MAY IT PLEASE YOUR HONOUR:

The undersigned begs to present, for the consideration of your Honour, the Report of the Entomological Society of Ontario for 1914.

Respectfully submitted,

JAMES S. DUFF,

Minister of Agriculture.

Toronto, 1915.

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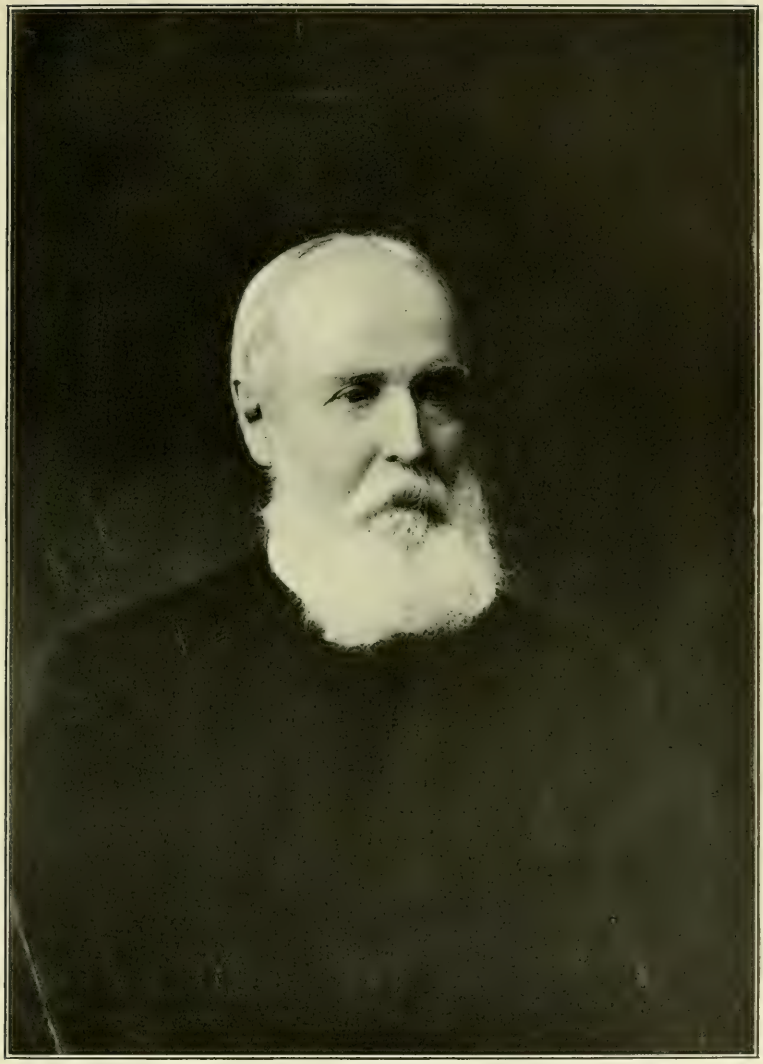
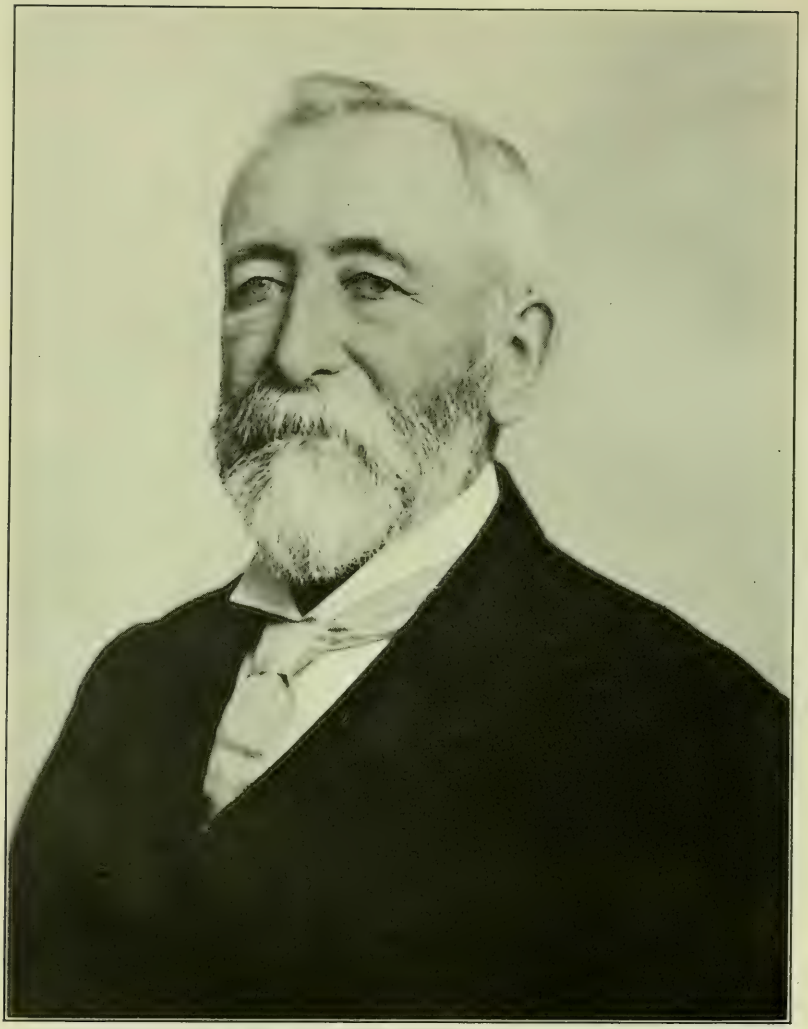


Rev. Dr. C. J. S. Bethune.

(See page 30.)



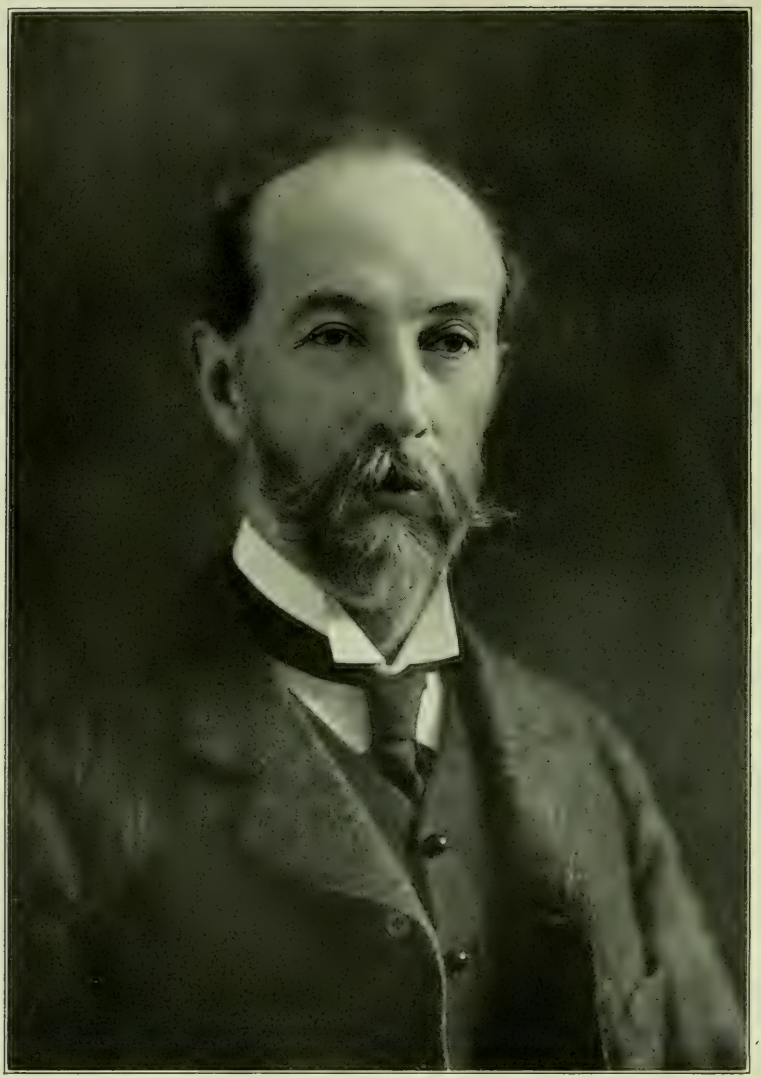
Dr. William Saunders, C.M.G.

(See page 29.)

HENRI FABRE

In his room and seated at the table where he wrote his "Souvenirs Entomologiques."

(Illustration reproduced from "*L'Illustration*," to which paper grateful acknowledgments are made.) (See page 61.)



Henry H. Lyman, M.A.
(See page 118.)

FORTY-FIFTH ANNUAL REPORT

OF THE

Entomological Society of Ontario

1914.

To the Honourable James S. Duff, Minister of Agriculture.

SIR,—I have the honour to present herewith the Forty-fifth Annual Report of the Entomological Society of Ontario, containing the proceedings of the Fifty-first Annual Meeting, which was held at Toronto on the 5th and 6th of November, 1914.

The meeting was well attended, and much discussion took place on various subjects of importance, particularly on the outbreak of the Army-worm in Canada in 1914. A full report of these discussions is given in the following pages, together with the papers and addresses presented, and the reports of the various officers and branches of the Society.

The work of the Society continues to be carried on with vigor and enthusiasm, the activity of the British Columbia Branch, which a few years ago had been entirely suspended, being worthy of special mention.

The Canadian Entomologist, the Society's monthly journal, continues to maintain its wide circulation in spite of the increased subscription price. The forty-sixth volume now completed, is the largest and most fully illustrated that has yet been published.

I have the honour to be, Sir,

Your obedient servant,

EDMUND M. WALKER,

Editor.

Department of Biology,
University of Toronto.

Entomological Society of Ontario

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FINANCIAL STATEMENT

For the Year Ending October 31st, 1915

Receipts.

Balance 1912-13	$599 09
Dues	133 65
Subscriptions	455 05
Advertising	16 94
Government grant	1,000 00
Reports and back numbers	188 00
Cork and pins	61 19
Bank interest	14 01
	$2,467 93

Expenditures.

Cork and pins	$33 64
Printing	1,509 49
Expense	33 75
Salaries	250 00
Library	38 83
Annual meeting	16 00
Annual report	85 00
Bank exchange	8 90
Balance on hand	492 32
	$2,467 93

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Respectfully submitted,
A. W. Baker,
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Mackie, Donald . . . . . Edmonton.
Moody, Miss . . . . . Calgary.
Tanner, H. E. . . . . Clyde.
Whitehouse, F. C. . . . . Red Deer.

Manitoba.

Criddle, Norman . . . . . Treesbank.
Hunter, Dr. A. J. . . . . Teulon.
Wallis, J. B. . . . . Winnipeg.

Nova Scotia.

Allen, E. C. . . . . Yarmouth.
Brittain, W. H. . . . . Truro.
Good, C. A. . . . . "
MacKay, Dr. A. H. . . . . Halifax.
Payne, H. G. . . . . Granville Ferry

New Brunswick.

Vroom, J. . . . . St. Stephen.

Saskatchewan.

Androchowicz, E. . . . . Humboldt.
Johnson, G. S. . . . . Moose Jaw.
McCulloch, A. J. . . . . Regina.
Neville, S. J. . . . . Cottonwood.
Willing, Prof. T. N. . . . . Saskatoon.

BRITISH COLUMBIA.

Abbott, R. C. ..... Mission City.
Abbs, A. W. ..... Vancouver.
Abriel, T. ..... Nakusp.
Anderson, E. M. ..... Victoria.
Anderson, J. R. ..... "
Angus, M. ..... Peachland.
Bain, T. H. ..... N. Vancouver.
Banks, W. W. ..... Salmon Arm.
Barnhill, E. E. ..... Kelowna.
Bird, M. L. ..... Vancouver.
Blackmore, C. H. ..... Victoria.
Brand, James ..... Vancouver.
Brealey, A. ..... Hatzic.
Brett, W. F. ..... Armstrong.
Breun, L. A. ..... Victoria.
Bryant, T. ..... Ladysmith.
Brydon, J. M. ..... Victoria.
Bush, A. H. ..... Vancouver.
Chapman, C. ..... Vancouver.
Clark, R. ..... "
Cockle, J. W. ..... Kaslo.
Collins, H. W. ..... Grand Forks.
Colpits, R. D. ..... Revelstoke.
Creese, H. H. ..... Kelowna.
Croker, A. ..... Victoria.
Cunningham, T. ..... Vancouver.
Currie, H. B. ..... Salmon Arm.
Davidson, J. T. ..... Vancouver.
Day, G. O. ..... Vancouver Island.
Evans, H. H. ..... Okanagan Centre.
French, P. E. ..... Salmon Arm.
Fulton, C. ..... Kelowna.
Fulton, G. H. ..... Port Haney.
Gavet, D. ..... Vancouver.
Gemmel, M. ..... Sechelt.
Getchell, F. H. ..... Vancouver.
Hadwen, Dr. S. ..... Agassiz.
Hanham, A. W. ..... Duncan's Station.
Harvey, R. V. ..... Victoria.
Heselwood, R. J. ..... Kelowna.
Hill, Tom ..... Vernon.
Hill-Tout, W. S. ..... Abbotsford.
Hippisley, Mrs. ..... Terrace.
Hoy, B. ..... Vernon.
Hugh, W. ..... Victoria.
Hunt, E. C. ..... Creator.
Jackson, W. ..... Creston.
James, F. T. ..... Victoria.
Kyte, R. J. ..... Notch Hill.
Landells, R. ..... Golden.
Lang, W. A. ..... Peachland.
Leach, D. H. ..... Salmon Arm.
Lyne, W. H. ..... Vancouver.
Matheson, J. B. ..... Kelowna.
McCubbing, C. ..... Salmon Arm.
McHardy, C. F. ..... Nelson.
McKenzie, K. ..... Kelowna.
Melhuish, J. S. ..... Walhachin.
Middleton, M. ..... Nelson.
Mitchell, D. ..... Tappin.
Nicolle, W. ..... Nelson.
Norman, P. ..... Victoria.
Northcote, T. H. ..... Mission City.
Palmer, L. L. ..... Vernon.
Palmer, R. M. ..... South Cowichan
Parham, G. L. ..... Invermere.
Patch, A. M. W. ..... Vancouver.
Peters, R. ..... Victoria.
Reed, E. Baynes ..... "
Rich, Edith ..... Ladner.
Rine, Henry ..... Victoria.
Robertson, W. H. ..... "
Robinson, E. H. ..... "
Ross, A. H. ..... Nelson.
Rowland, A. ..... Vancouver.
Ruhman, M. ..... Vernon.
Russell, D. ..... Lavington.
Scott, Col. B. ..... Salmon Arm.
Scott, W. E. ..... Victoria.
Sherman, R. S. ..... Vancouver.
Simons, A. E. ..... "
Simms, A. C. ..... Summerland
Skinner, E. M. ..... Victoria.
Stanton, T. H. ..... Duncans.
Taylor, L. E. ..... Kelowna.
Thomson, C. ..... W. Summerland.
Tomlinson, A. H. ..... Prince Rupert.
Treherne, R. C. ..... Agassiz.
Venables, E. P. ..... Vernon.
Wallace, E. A. ..... Victoria.
Ward, W. E. ..... Vancouver.
Whiting, H. H. ..... Rock Creek.
Wilkerson, G. E. ..... Victoria.
Wilson, E. H. ..... Armstrong.
Wilson, Tom ..... Vancouver.
Winslow, R. M. ..... Victoria.
White, E. W. ..... Sardis.
Woods, Mrs. E. A. ..... Grand Prairie.

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Cockerell, Prof. T. D. A. .. Boulder, Col.
Comstock, Prof. J. H. ..... Ithaca, N.Y.
Cresson, Ezra T. ..... Philadelphia, Pa.
Felt, Dr. E. P. ..... Albany, N.Y.
Howard, Dr. L. O. ..... Washington, D.C.
Webster, Prof. F. M. ..... "
Wickham, Prof. H. F. ..... Iowa City, Ia.

LIFE MEMBERS

Bethune, Rev. C. J. S. .....
Professor of Entomology, Ontario Agricultural College. Guelph.
Fyles, Rev. Dr. T. W. .... Ottawa.
Reed, E. Baynes .....
Director of the Meteorological Station. Victoria.

The Entomological Society of Ontario

ANNUAL MEETING

The Fifty-first Annual Meeting of the Entomological Society of Ontario was held at Toronto on Thursday and Friday, November 5 and 6, 1914, Dr. C. Gordon Hewitt, President of the Society, occupying the chair throughout the sessions. Among the members present were: Prof. J. H. Comstock, Cornell University, Ithaca, N.Y.; Rev. T. W. Fyles, Ottawa; Dr. C. G. Hewitt and Messrs. A. Gibson and J. M. Swaine, Entomological Branch, Ottawa; Messrs. N. Criddle, W. A. Ross, E. H. Strickland and H. F. Hudson, Field Officers of the Branch; Rev. Prof. C. J. S. Bethune, Prof. L. Caesar and Mr. A. W. Baker, Ontario Agricultural College, Guelph; Prof. Wm. Lochhead, Macdonald College, Que.; Prof. J. Dearness, London; Dr. A. Cosens, Prof. E. M. Walker and Messrs. J. B. Williams, A. Smith, C. Snazelle, E. H. Craigie, Geo. Duff and S. Logier, Toronto; Mr. F. J. A. Morris, Peterborough; Mr. J. D. Evans, Trenton; Prof. W. H. Brittain, Truro, N.S.; and Mr. Vernon King, Charleston, Mo.

Among the visitors were Prof. C. R. Crosby, Cornell University, Ithaca, N.Y.; Mr. J. C. Chapais, St. Denis-en-bas, Que.; Rev. Father Leopold, La Trappe, Que., and Messrs. A. B. Baird and S. H. Lord, Ontario Agricultural College, Guelph.

On Thursday morning a meeting of the Council was held in the Biological Building of the University of Toronto. Various matters of business were brought up and discussed and the report of the proceedings of the Society during the past year was drawn up. Much satisfaction was expressed regarding the vigorous condition of the Society, particularly in the rapid development of the British Columbia Branch, and in the Society's excellent financial position. A suggestion that the next Annual Meeting be held at Ottawa was afterwards put before the general meeting and adopted.

In the afternoon the Society met in the Lecture Room of the Royal Canadian Institute, the proceedings commencing at two o'clock. The chair was taken by Dr. Hewitt, the President, and the first order of business was the reading of the reports of the Directors on the insects of the season in their respective divisions.

REPORTS ON INSECTS OF THE YEAR.

Division No. 1, Ottawa District—Arthur Gibson, Entomological Branch, Ottawa.

During the growing season of 1914 serious outbreaks of certain well-known insects occurred in the Ottawa District. Weather conditions were very favourable for insect increase and many letters relating to injurious species were received from farmers and others. The following are the pests chiefly complained of:

Insects Attacking Field Crops.

The Army-worm (*Leucania unipuncta*). Immediately following the outbreak of the Army-worm in Brant County, western Ontario, considerable anxiety among farmers was experienced when infestations were discovered at Carp, Kin-

burn and one or two other places in the Ottawa District. The Carp and Kinburn outbreaks were investigated by me on July 21st, when fields of oats, barley and corn were found to be freely infested. Many hundreds of thousands of the worms were present. The Army-worm outbreak in Canada, however, during the past season is discussed on page 72.

Locusts. The Migratory Locust (*Melanoplus atlanis*) was again enormously abundant at Bowesville, near Ottawa, and at several other places in the district. The crops chiefly attacked were those which I mentioned in my report last year, viz., oats, barley, timothy and corn. Rather extensive experiments were conducted by the Entomological Branch with the Kansas poison bran formula and other remedies. A brief account of this work is given on page 97. The Kansas formula gave excellent results and we have no hesitation whatever in recommending it.

Cutworms. These destructive caterpillars were again very abundant throughout the district. The interesting outbreak was that of the Common Striped Cutworm (*Euxoa tessellata*), which was very abundant on the Central Experimental Farm, destroying annual flowering plants, tobacco, etc. The Dark-sided Cutworm (*Euxoa messoria*), was also numerous and ruined many young plants, particularly vegetables. The Red-backed Cutworm (*Euxoa ochrogaster*) was injurious in the district and reports were received of injury to peas, beans, clover, corn, mangels and carrots. The Glassy Cutworm (*Hadena devastatrix*) was present in numbers in tobacco fields near Ottawa.

Root Maggots. These regularly-occurring insects were again very destructive in eastern Ontario; and a good remedy for the preservation of radishes and onions is still a desideratum. Cabbages and cauliflowers were again protected on the Central Experimental Farm by placing around them at the time of planting out, discs made from tarred felt paper. Wherever they were applied properly excellent results were obtained.

The Carrot Rust Fly (*Psila rosæ*). My attention was called to an outbreak of this insect in a private garden in Ottawa. At the time of my visit, July 13, the bed of carrots had been completely destroyed, and the tops were wilted and lying on the ground. It is several years since the insect has occurred injuriously in the Ottawa District. Unfortunately, it is rather difficult to control. When young carrots are being thinned out, the spraying of the remaining plants with ordinary kerosene emulsion, one part in nine of water, has been found useful as a protection against injury by this insect. In the Maritime Provinces, where the insect has also been destructive the past season, some growers found the kerosene emulsion of value. Applications should be made once a week during June and first half of July.

The Celery Caterpillar (*Papilio polyxenes*) was more than usually abundant in the district, the chief injury noticed being to parsley in early July. Owing to their conspicuous markings—green with transverse black stripes—they are easily seen, and unless present in extraordinary numbers the remedy of hand-picking is usually all that is necessary.

The Diamond-back Moth (*Plutella maculipennis*) was very apparent in the latter half of June and its injuries were readily observed in fields of cabbages. It is not a difficult insect to control. Paris green in the ordinary strength (1 pound to 160 gallons of water) or arsenate of lead (2 pounds to 40 gallons of water) will control the caterpillars. It is perfectly safe to use either of these arsenites up to a week or two of the time the cabbages are to be used as food.

When spraying cabbages, on account of the smoothness of the leaves a "sticker" should be added to the mixture. Such can be made by boiling together for about an hour two pounds of resin and one pound of sal soda (crystals) in a gallon of water. This is sufficient for 40 gallons and if used with Paris green, one pound of fresh lime should be added.

Attacking Fruit and Forest Trees.

The two species of Tent Caterpillars, the American Tent (*Malacosoma americana*) and the Forest Tent (*Malacosoma disstria*) were again noticeably present in many places, but the injury was much less than that effected in either of the three previous years.

The Pear Slug (*Eriocampoides limacina*) was abundant in orchards on plum and cherry trees. It is an easy insect to control. If only a few trees are attacked freshly slaked lime dusted on the leaves is a sufficient remedy. If the occurrence is widespread, spraying with either Paris green or arsenate of lead should be adopted.

Other common pests such as the Codling Moth, the Eye-spotted Bud-moth and the Cigar-case Bearer were troublesome in unsprayed orchards.

Attacking Greenhouse and Garden Plants.

The Rose Leaf-hopper (*Typhlocyba rosæ*). The foliage of roses throughout the district was heavily infested with this insect. The whitish patches resulting from the attack of the insects were very conspicuous in the middle of June. In some gardens the attack was stopped by a weak application of "Black Leaf 40."

The Violet Sawfly (*Emphytus canadensis*). Pansies were injured to some extent by the bluish-black false caterpillars of this sawfly. At Ottawa they were found in the middle of June, and at this time the larvæ were approaching maturity. They feed, as a rule, during the night. We have found that dusting the plants in the evening with white hellebore, or with Paris green mixed with 50 times its weight of common flour, will destroy the larvæ.

The Tarnished Plant Bug (*Lygus pratensis*) was destructive to dahlias and other flowering plants. It is an extremely difficult insect to control. I know of no satisfactory remedy. The bugs are most active during the heat of the day, but in the early morning they are comparatively sluggish, at which time they may be beaten off the plants into an inverted umbrella and then put into some receptacle containing coal oil and water.

Aphids of many kinds were more or less destructive to greenhouse and garden plants. The Greenhouse Leaf-tyer (*Phlyctænia rubigalis*) was present noticeably in one greenhouse, and Red Spider was responsible for much damage to many kinds of plants.

At the conclusion of his report, Mr. Gibson exhibited a specimen of the European Praying Mantis (*Mantis religiosa* L.), and said that the specimen was found in a potato field at Carrying Place, Prince Edward County, Ontario. It was, he thought the first specimen ever sent in to the Department at Ottawa. The habits of the insect were briefly discribed and reference given to the first American records in New York State.

Dr. Bethune: I had a specimen taken near Simcoe, Norfolk Co., about two years ago. I thought that was unique for Ontario.

Division No. 2, Orillia District—C. E. Grant, Orillia.

I have not been able to give much time to the recording of insect destructiveness this season. I wish, however, to note the appearance in this neighbourhood of the two asparagus beetles, *Crioceris asparagi* and *C. 12-punctatus.* I visited the gardens of several friends who had complained of something that was eating their asparagus. In two of these places the tops of the plants looked like a lot of dry sticks, they were so completely stripped of foliage. I found both species of beetles in abundance on the plants. I think they were both equally plentiful. I was also informed that the pest had been noticed the year before, but I never had observed their appearance, though I had been on the lookout for them for some time.

Army Worm (*Leucania unipuncta*). I was informed that in the Township of Orillia some eight or ten miles from town there was a slight outbreak of this insect, and the moths were very numerous at light here, but I did not see any destruction close to town. I never saw the moths so abundant since 1896 when there was considerable damage done in the Township of Mara, County of Ontario, which abuts on the boundaries of Orillia.

June Beetles (*Lachnosterna*). I never saw these insects so abundant It was impossible to sit near the lamp which I keep lighted to attract insects, on account of the constant bombardment by them.

Cutworms were not reported plentiful this season.

Onion and Cabbage Maggots were rather plentiful.

Raspberry Cane Borer (*Agrilus ruficollis*). This species has been very abundant the last few years, the wilted canes shewing up conspicuously.

Tent Caterpillars (*Malacosoma americana and M. disstria*) were abundant. Their webbs were noticed and the moths were abundant in July and lasted right into August.

I took a specimen of *Telea polyphemus* on August 20th, quite a late record for that insect.

I took quite a few new insects but not at present being able to determine them, I must leave a report of them to a future time.

Division No. 3, Toronto District—A. Cosens.

During the season the following insect pests were abundant enough to attract attention. The Cutworm (*Euxoa*), was particularly destructive in the northern part of the city. In that district a thin layer of loam covers a sandy sub-stratum, furnishing suitable conditions for the maturing of the larvæ. In some gardens the tomato and cabbage plants were regularly cut off until a sprinkling of poisoned bran was used with good results. In the same locality the Onion Maggot (*Pegomyia cepetorum*) has been unusually abundant during the summer. A dahlia grower, who invariably has a number of flower buds destroyed by the attacks of the Tarnished Plant Bug (*Lygus pratensis* L.), informs me that this insect was not so plentiful as usual this season, but Dr. Walker states that he has found the Four-Lined Plant Bug (*Poecilocapsus lineatus* Fabr.) in large numbers on many different species of plants. The market gardeners of Mt. Dennis, a suburb of Toronto, state that the larvæ of the May Beetle (*Lachnosterna fusca* Fröh.) are becoming more numerous. Two apparent causes are contributary to this condition. These gardens are situated in a swamp area, which is cleared and drained a few acres at a time, and as the trees are gradually being removed the birds, that act as a natural check on this pest, are forced to nest in other localities. Also

the star-nosed mole, that feeds on the larvæ, is dug out and killed whenever possible. This can probably be defended, as the undermining of the moles often causes breaks in the rows of vegetables due to the wilting of the plants.

Last fall the larvæ of *Metzneria lappella* Linn., were exceedingly abundant in the heads of the Small Burdock (*Arctium minus* Bernh.). In some infected plants almost every head contained from one to three occupants. A collection was made and kept in a cool place during the winter and a large number of moths emerged in June. Rev. Dr. Fyles first reported this insect in 1898, having found it at Levis, Quebec, where he thinks it was probably first introduced into Canada. It has been in Toronto at least since 1904. In looking over the published life histories of this insect I have not seen mentioned the following feature that appears to be a distinct adaptation to its mode of life. After the moths emerge from the seed heads, small silken tubes are to be seen projecting beyond the scales of the involucre. Through each tube a moth has been able to pass safely the hooked points of the scales and reach the outside. These tubes are either formed by the larvæ in the spring before pupation or are a part of their silken, winter envelope which has been torn away and carried out by the moth during its emergence. I have not yet definitely decided by observation between the two explanations. Owing to the large number of seeds that are prevented from germinating by the larvæ of this species, it is usually considered to be beneficial, but the fact that fewer seedlings will thus appear at one place may operate favorably to the burdock owing to the natural thinning out that has resulted.

While in the vicinity of Toronto the good collecting grounds are gradually being reduced in number, some still remain. Among the best of these is the Mt. Dennis locality mentioned above. In that district a level depressed stretch, several acres in extent, of rich peaty soil produces a rank growth of asters, golden rods and other plants adapted to such a habitat. Skirting this low-lying area are sloping ridges still covered with the oaks and maples of the original forest, while willows, dogwood and viburnum form a transition zone between the highland and the typical meadow flora. On the 17th of July, while Mr. Nash and I were collecting over the low land, we found the butterfly *Melitaea phaeton* Drury, quite plentiful. Numbers of them were flitting about in company with the more common Fritillaries and Meadowbrowns. We captured a dozen specimens, and could have taken many more. The food plant of the species, Turtle Head (*Chelone glabra* L.,) is not plentiful in the locality, but Mr. Nash found colonies of the larvæ established on this plant later in the season.

A very casual examination of gall literature reveals a large number of species, the producers of which are undescribed. To this group belongs the Cynipid gall on the petiole of Wild Strawberry (*Fragaria virginiana* Duch.). The deformity consists of an elongated cylindrical enlargement that when mature shows shallow annular constrictions at the junction of the larval cells giving the gall a somewhat segmented appearance. As the leaves, on which the galls are produced, wither before these are mature it is very difficult to find specimens at that stage. The plan that suggested itself was to transplant the host where it could be kept under observation. From material thus treated, producers emerged from May 12th to 15th. Specimens were sent to Wm. Beutenmüller, New York, and he reports them to be an undescribed species of Diastrophus.

The sawfly gall on the base of the petiole of *Salix humilis* Marsh, is common in High Park of this city, and last fall it was particularly plentiful. Induced by this fact to forget several unsuccessful attempts to rear the producer, I collected

a large number of the galls and kept them during the winter under as nearly natural conditions as possible. A number pupated a couple of inches below the surface of the soil in the breeding jar, and several adults emerged between June 3rd and 10th. S. A. Rohwer, Washington, D.C., to whom specimens were sent, has not yet published his description, but has sent me a manuscript copy of it. The species which has been named *Euura cosensi* n. sp., is said to be closely connected with *Euura nodus* Walsh, a form that produces stem galls on *Salix longifolia* Muhl. From this species it may readily be differentiated by the shape of the sheath and the different sculpture of the head.

The following list includes all the sawfly gall producers as far as reported from this locality.

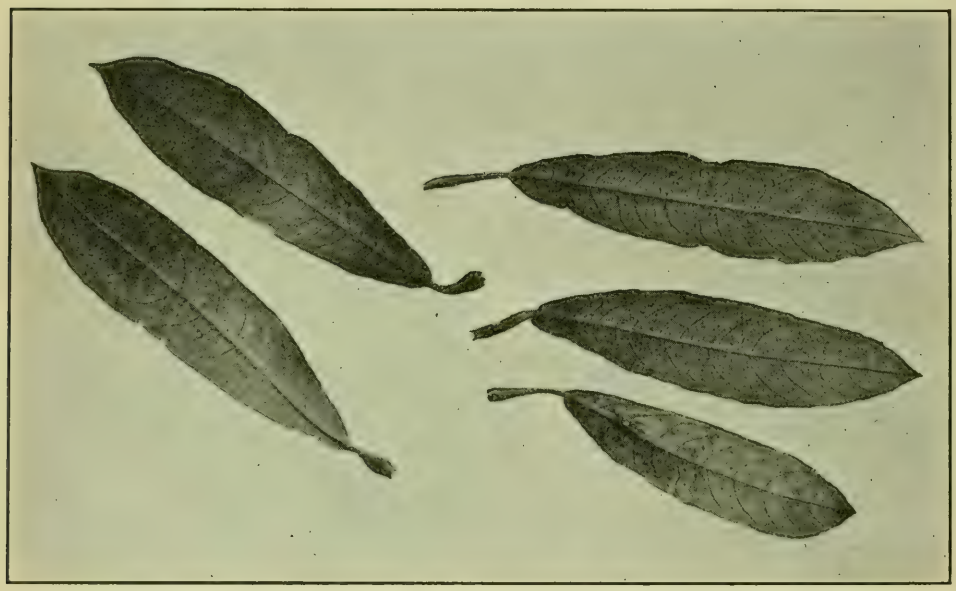

Fig. 1.—*Euura cosensi* Rohwer, a sawfly gall on the leaf petiole of *Salix humilis* Marsh.

Euura cosensi Rohwer.
Host, *Salix humilis* Marsh.

The gall, which is produced on the leaf petiole, is conoidal in shape with a long tapering point, towards the blade of the leaf.

Euura gemma Walsh.
Host, *Salix humilis* Marsh.

In this species, the gall is formed by the abnormal swelling of a lateral bud.

Euura ovum Walsh.
Host, *Salix humilis* Marsh.

An elongated oval swelling on one side of a twig constitutes the gall in this case.

The three preceding species are common in and near Toronto.

Euura serissimæ Rohwer.
Host, *Salix serissima* Fernald.

The gall consists of the enlarged petiole of the leaf. The leaves infested are borne on the branchlets from which the pistillate catkins spring.

In this vicinity only a few examples of the host plant occur, but all of these seem to be infested with the gall.

Pontania crassicornis Rohwer.
Host, *Salix humilis* Marsh.

The gall resembles the well known *Pontania pomum,* Walsh, in shape, but is considerably smaller. It is densely pubescent and several are usually crowded together on one leaf.

Pontania desmodiodes Walsh.
Host, *Salix humilis* Marsh.

A smooth, flattish gall with a semicircular outline originating from the mesophyll of the leaf of the host.

The last two galls mentioned are abundant in this locality.

Especially in the western part of the city the numerous ridges and plains consist largely of sand sorted over and deposited by the wave action of the glacial. Lake Iroquois. In the light soil thus produced pines and oaks flourish and in the open spaces among these *Salix humilis* finds an ideal habitat. The resulting frequent occurrence of this food plant contributes to the abundance of several of our sawfly galls parasitic on this host.

Pontania hyalina Norton.
Host, *Salix alba* L.

The galls are arranged in two almost parallel rows, one on each side of the midrib of the leaf.

This is the most plentiful willow gall in this vicinity. The host has been planted in large numbers and few of these escape infection.

Pontania lucidæ Rohwer.
Host, *Salix lucida* Muhl.

The gall is produced as an enlargement of the petiole or midrib of the leaf. Throughout the district in general this species is not common.

Pontania pisum Walsh.
Host, *Salix discolor* Muhl.

An almost spherical pea-like gall, with a small point of attachment to the leaf of the host.

Only rarely found in the locality.

Pontania pomum Walsh.
Host, *Salix cordata* Muhl.

A large globular gall originating from the leaf of the host. It is greenish-yellow in colour usually with a rosy tint on one side.

Among the numerous sand ridges, referred to previously, are many streams and ponds of water. These are skirted, often for long stretches, by a screen of the heart-leaved willow. The majority of these host plants are always infested with this gall.

The President: The heartiest thanks of the Society are due to Dr. Cosens for his excellent report, full as it is of the most valuable original observations which should form the basis of considerable further work, and be a very welcome contribution to our Proceedings.

DIVISION No. 5, PORT HOPE DISTRICT—F. J. A. MORRIS, PETERBOROUGH.

From Port Hope, Mr. H. L. Bowers records:—"Aphids very bad on peas and consequently Coccinellidæ very plentiful; cut-worms very bad in spring, destroying many cabbage and tomato plants. The turnip Root-maggot was also bad. The White Cabbage Butterfly did a great amount of damage; *Pieris protodice* was plentiful. The Army Worm caused no damage near Port Hope—a few were noticed not many miles west; about fifty of the moths were taken in a light trap. Tent Caterpillars were numerous and caused some damage; the Forest Tents were very noticeable. The Milkweed Butterfly was very rare last year,

Fig. 2.—*Pontania pomum* Walsh, a sawfly gall on the leaf on *Salix cordata* Muhl.

but was more numerous this year than at any time in the last five seasons. Butterflies of the genera *Argynnis, Phyciodes* and *Grapta* were scarce; *Limenitis arthemis* very common; also *Chrysophanus thoe; Pieris napi* and varieties common. All *Papilios* scarce. May-beetles were very bad, and much trouble from their grubs may be looked for later. They ate the leaves from very many young fruit trees.

Below is a list of captures:—

Apantesis intermedia.
Apantesis virguncula.
Apantesis parthenice.
Lycomorpha pholas.
Euchætias oregonensis.
Microcœlia diphtheroides.

Microcœlia diphtheroides var. *obliterata.*
Euchalcia putnami.
Euchalcia venusta.
Euchalcia cuspidea.
Euchalcia contexta.
Chamyris cerintha.
Catocala relicta.
Catocala relicta bianca.
Synelys alabastaria.
Caripeta divisata.
Synanthedon acerni.
Atrytone pocahontas.

Mr. R. S. Duncan (from Port Hope) of the Department of Agriculture writes in answer to enquiries that he has not noticed many insect pests about the orchards. He was called on to fight the Army Worm (1) on the Cobourg Road east of Port Hope, and (2) on farms near Charlecote, Perrytown, Newcastle and Solina. The pest was bad, but not nearly so troublesome as in Western Ontario.

The insect collections made by school children have been steadily increasing. At each of the five school fairs in the county, from two to seven collections of insects have been exhibited; some of them very neatly and correctly labelled.

Dr. Watson reports some interesting captures in Coleoptera, including a longicorn (*Goes oculata*) new to his collection taken under a butternut tree during the spell of unusually hot weather about the middle of September.

In the neighbourhood of Peterborough the most noticeable pest was the Tent Caterpillar. Very early in the spring the webs became conspicuous on wild cherry, hawthorn and other trees and shrubs about the lanes and fence-corners outside the city. The newly hatched grubs destroyed even foliage-buds before the leaves had expanded. In neglected orchards they were also very abundant, and had been nearly as bad the season before. Next to nothing was done to cope with the pest till the caterpillars were nearly full-grown; there was then an agitation, and in several places torches were used, but more than half the larvæ escaped by scattering. Towards the end of June the full-grown larvæ began to swarm in masses round the lower trunks of the trees and it was only then that the extent of the mischief became apparent; throughout the city the shade trees showed great ravages in the heart of the foliage, especially basswood, maple and elm. For a week when the creatures swarmed in great masses on the tree trunks, they could be destroyed very easily, but the job was evidently too disagreeable and was left undone. In every mass examined a few of the individual worms proved to be those of the Orchard Tent Caterpillar, the vast majority being the Forest Tent Caterpillar. In an orchard adjoining our house every tree was stripped of foliage and when fire was applied to the webs so many of the caterpillars escaped that the houses on all sides were fairly besieged and many garden shrubs, rambler roses, for instance, were stripped.

In the "fresh fields and pastures new" afforded by a change of residence some interesting observations were made during the season, and quite a large number of additions secured to your district director's collection of Coleoptera, the collecting grounds being chiefly fungus, the fermenting bark, trunks and branches of newly felled trees, and green foliage. At the beginning of May a large alder swamp, partly cleared, yielded some interesting forms of Chrysomelian, at first, of course, specimens that had hibernated. These included three species

of *Chrysomela,* viz., a well-marked variety of *C. scalaris* (if the normal form is that found on basswood), and a very handsome form of *C. philadelphica,* more robust than the normal form and with the ground colour rich chestnut; both of these were taken on alder, feeding freely and abundant. The normal form of *C. philadelphica* was taken in the same locality on dogwood, and *C. bigsbyana* on willow. Later on several interesting longicorns were captured on the trunks of newly-felled white pine, attracted by the fermenting sap and breeding there. Other captures were made on some fallen basswood, and in fungus that had freshly spread over the top of basswood stumps. A pair of longicorns, quite new to your collector, was captured in alder foliage at the end of May; and in the last week of June nearly fifty specimens of the beautiful Elder Borer (*Desmocerus palliatus*). I had only once before seen this creature alive and for the benefit of other collectors I will add some notes. The beetles may be looked for first about June 20th in our latitude and may be taken as late as July 20th. They were nearly all captured on Early Elder (*Sambucus racemosa*), which at this season is bright with crimson clusters of ripe berries; the later species of Elder (*S. canadensis*) having just opened its flat cymes of white blossom. The beetles love to rest on the under side of the foliage, and more frequently were found in small thickets of Elder within the borders and under the shadow of hardwoods. Very few were found on the Late Elder and none on the blossom.

During July immense numbers of Rose Chafers (*Macrodactylus subspinosus*) were observed in High Park, Toronto, feeding on the pollen of New Jersey Tea, and a few on the Late Elder. About the 20th of July, some fifteen specimens of *Eupagonius subarmatus* were taken in Niagara Glen, breeding on the basswood. They were all captured on the underside of the foliage, their instinct to escape by dropping from their perch being utilized in their capture.

In August, while camping in the Algonquin Park I revisited a certain bay on White's Lake and found, after seven years, the same colony of *Phyllabrotica decorata* feeding on the same clump of Skull-cap (*Scutellaria galericulata*). On the willow bushes adjoining the railway *Disonycha caroliniana* was abundant, and among the raspberry patches a very wasp-like clear-wing moth was seen quite frequently.

The President: We are sorry that this report is the only contribution we shall have as a result of Mr. Morris' season's work. It is plain that he has lost none of his old enthusiasm and delight in his new locality.

Division No. 7, Niagara District—W. A. Ross, Jordan Harbour.

As insect pests have been very numerous and troublesome this past season in the Niagara District, I have before me the rather difficult task of condensing what would fill a respectable volume on economic entomology into a brief report.

Orchard Insects.

Apple Maggot (*Rhagoletis pomonella*). This year some further work was done on the control of the Apple Maggot. Two Hyslop crab-apple trees, nicely laden with fruit and as near alike as possible, were chosen and each was enclosed in a large cheese-cloth cage. One tree was sprayed four times with sweetened arsenate of lead (2-3 lbs. arsenate of lead: 10 lbs. molasses: 40 gals. water); the other was used as a check. Forty female and nineteen male flies were liberated on the treated tree and fourteen females and eleven males were confined in the check cage. No eggs were laid in the fruit on the sprayed tree, whereas practically

every apple on the check was infested with maggots. This experiment was duplicated by Mr. Lawson Cæsar and me in a large orchard near Mountain, and excellent results were obtained, about which Mr. Cæsar no doubt will have something to say.

Apple Aphids. This spring at Vineland Station Laboratory we commenced an investigation of three species of plant lice injurious to apple trees—*Aphis pomi, A. sorbi, A. avenæ*. *Aphis pomi* was found to be the most destructive species in nurseries and young orchards, but *sorbi* proved to be the greatest depredator in bearing orchards. The life histories of the three species were studied and the important discovery was made that *A. sorbi* spends the summer on the common plantain (*Plantago major*) and on ribgrass (*P. lanceolata*). (It is very probable that other species of Plantago act as summer hosts). Another interesting point demonstrated was that *sorbi* will remain on the apple all year if overcrowding of the aphids is prevented.

As our study of remedial measures was of a preparatory nature, I shall not mention this phase of the investigation except to call your attention to the gratifying results obtained in the destruction of eggs by fumigation. Seven young trees well stocked with healthy eggs and all taken from the same nursery were used in the experiment. Three of them were fumigated with hydrocyanic acid gas, 1 oz.—100 cu. ft., 1.1.3 formula and the others were used as a check. None of the eggs on the fumigated trees hatched, whereas about 30 per cent. hatched on the check.

The Plum Curculio (*Conotrachelus nenuphar*) was exceedingly troublesome on the Experimental Farm at Vineland. Apples, pears and stone fruits were attacked. Apricots and crab apples suffered most severely from its depredations.

The Pear Psylla (*Psylla pyricola*) was responsible for a considerable amount of damage in several Queenston pear orchards and in one near Beamsville.

The Apple Leaf-hopper (*Empoasca mali*) and its work—sickly, mottled and sometimes curled foliage—were only too evident in some apple orchards in the Vineland district.

Cecropia (*Samia cecropia*) was quite abundant this past season. Larvæ taken from plum and apple trees were sent into my laboratory frequently, and during June numerous adults were found fluttering against the windows of the Administration Building, Experimental Farm, Vineland.

Trumpet Leaf Miner (*Tischeria malifoliella*). This autumn I have noticed more work of the Trumpet Leaf Miner on apple foliage than I have seen during previous years.

Tetranychus pilosus. Some experimental work on the control of this plum mite was done on a small scale at Vineland Station, and excellent results were obtained from (1) flour paste (4 lbs.-40 gals.), (2) lime sulphur (1.009 sp. gr.) and flour paste (2 lbs.-40 gals.), (3) lime sulphur (1.009) and tobacco decoction (1 lb.-2 gals.). The last two mixtures proved to be more reliable than the flour paste.

Cherry Fruit-flies. I observed *Rhagoletis cingulata* at work amongst Montmorency and English Morello cherries in a Beamsville orchard, and on the so-called Mountain south of Vineland, I found the fruit on cherry trees growing along the roadsides badly infested with maggots.

The Grape Flea-beetle (*Haltica chalybea*) was present in injurious numbers in several sections of the Niagara District this spring. Numerous complaints were received regarding the depredations of the adults on the buds and of the larvæ on the foliage of grape vines.

THE RASPBERRY SAWFLY (*Monophadnoides rubi*) was unusually abundant this year and many raspberry bushes were badly injured by it. In an experiment with arsenate of lead (3 lbs. to 40 gals.) 100 per cent. of the larvæ were killed, but unfortunately the spray severely burned the raspberry foliage. This injury was not due, as one would suppose, to an excessive amount of arsenic oxide in the arsenate of lead, because according to an analysis made by Dr. Shutt, Dominion Chemist, only .31 per cent. of the soluble oxide was present. Can anyone present suggest a factor or factors which might have been responsible for the burning of the foliage?

THE CURRANT WORM (*Pteronus ribesii*) and the currant aphid (*Myzus ribis*) were very plentiful this past season.

White Grubs again proved themselves to be relentless enemies of the strawberry grower. In the strawberry plantation of the Vineland Experimental Farm, a large percentage of the plants had to be dug up because of white grub injury to the roots.

FIELD AND TRUCK CROP INSECTS.

PEA APHIS (*Macrosiphum pisi*). There was a serious outbreak of pea-aphis this summer in Grantham township, near St. Catharines. When I visited the infested fields during mid-July, I found the outbreak on the decline, due to the effective work of coccinellids, their larvæ, syrphid maggots, aphis-lions and braconids. Unfortunately the work of these checks came too late to prevent serious injury to the pea crop.

On the Vineland Experimental Farm I noticed that where peas were grown under irrigation (overhead system) the aphids were satisfactorily controlled by a fungus, *Entomophthora aphidis*.

THE ARMY WORM (*Leucania unipuncta*). In regard to the remarkable prevalence of army worm in Ontario this year, I am pleased to say that the outbreak in the Niagara District was comparatively very light. Corn suffered more than any other crop.

ASPARAGUS BEETLES (*Crioceris asparagi* and *C. duodecimpunctata*) were unusually destructive in some localities.

SQUASH BUGS (*Anasa tristis*) and Cucumber beetles (*Diabrotica vittata*) were responsible for a considerable amount of damage to cucurbits.

THE POTATO BEETLE (*Leptinotarsa decemlineata*) was remarkably scarce, at least in Vineland locality. In my own plot of potatoes I did not find a single beetle.

THE CABBAGE BUTTERFLY (*Pontia rapæ*) was quite abundant.

INSECTS ATTACKING TREES AND SHRUBS.

DATANA CATERPILLARS. Black Walnut trees were, in some cases, almost completely defoliated by *Datana integerimma*. and the larvæ of *D. ministra* were found feeding on American Elm and Basswood trees.

SAN JOSÉ SCALE (*Aspidiotus perniciosus*). A young Black Walnut tree on the Rittenhouse school grounds, Vineland Station, was killed by this destructive scale this year.

ELM APHIDS. Scotch elm trees growing in the vicinity of the Experimental Farm were attacked by the leaf curling species (*Schizoneura ulmi*) (*fodiens*) and by the gall-maker (*Tetraneura ulmisacculi*).

LOCUST BORER (*Cyllene robiniæ*). Because of the work of this notorious borer it seems to be impossible to grow black locust trees successfully in our neighbourhood. On the Experimental Farm lawn one tree was killed and another was rendered worthless by this insect. Adult beetles were very plentiful during August.

RED SPIDERS (*Tetranychus bicolor*) were abundant on oak and chestnut trees this past summer.

THE BASSWOOD LEAF-ROLLER (*Pantographa limata*) was very common in the Experimental Farm wood lot.

Rhopalosiphum ligustri. Private hedges in different sections of the Niagara District were severely injured by an aphid which I have every reason to believe is the European species, *R. ligustri.*

THE PLANT LOUSE (*Phyllaphis fagi*) was present in injurious numbers on copper beech trees.

The worst foe of our spruce trees and hedges, *Chermes abietis*, I am pleased to say, was exceedingly scarce last summer.

MISCELLANEOUS INSECTS.

Myzus persicæ was by far the most destructive aphid in the Experimental Farm greenhouses this year. It was especially troublesome on radishes.

THE VARIEGATED CUTWORM (*Peridroma saucia*) made itself notorious in a Niagara Falls greenhouse this month by attacking the heads of chrysanthemums and razing off the florets.

Dahlias grown in the Rittenhouse school gardens were a complete failure this year, because of the depredations of the TARNISHED PLANT BUG (*Lygus pratensis*).

This year superheating proved to be a highly satisfactory method of ridding houses of bedbugs (*Cimex lectularius*).

A considerable amount of wheat was ruined in a granary near Ball's Falls by the GRANARY WEEVIL (*Calandra granaria*).

THE PRESIDENT: I think Mr. Ross' report shows how very diligently he has worked at the Dominion Entomological Laboratory at Vineland. It refers to a number of subjects upon which probably some of the members here would like to ask questions.

PROF. CAESAR: In regard to the apple maggot, I had not intended making any comments until next year. The entomologists of the Provincial and Dominion Departments of Agriculture are working together on this pest. We have refrained from publishing up to the present, because we want to be absolutely sure of our results before we put them into print. I have selected one of the worst orchards I have seen for next year's test of the sweetened poison mixture. This year Mr. Ross and I co-operated in spraying 22 acres of apple orchard which was last year very bad with the Apple Maggot, or Railway Worm as it is commonly called. We feel sure that there were plenty of adults there this year. For instance, I took 400 live pupæ in two hours at the one place just by hand. The apples had been left piled up under the trees from last year as they could not be sold because of the insect. I simply removed the apples, took the pupæ out of the soil, put them into some earth and sent them to Mr. Ross, who used them in connection with caged trees. We sprayed this orchard twice, paying special attention that the spray should get on the underside of the leaves.

I did the first spraying and Mr. Ross the second. We sprayed the under surface of the leaves thoroughly. Both of us went back on September 15th and thoroughly examined the trees, and found but eight punctures in the whole orchard—that is in the 22 acres. I had chosen the orchard and had chosen the check. The check consisted of about two acres. To our surprise it was just as clean as the other part. I should have said, "in a way to our surprise," and yet the experience with the Cherry Fruit Fly shows that it should not be a surprise at all; for a check in the same orchard, unless it is a large one and on the side away from the prevailing wind, is almost useless. We went into the neighboring orchard and examined there and found that about fifty per cent. of the Tolman Sweets were punctured. We feel satisfied that there is no other explanation of the success of this orchard than the spraying.

THE PRESIDENT: Mr. Caesar's addition to the contribution of the discussion has shown how very important it is to carry on these experiments for several years even though you may think that you have secured conclusive results. Those who have followed the work which has been done on fruit-flies in general, but on the Apple Maggot in particular, will be impressed with the divergent character of the results, and the more you investigate the matter the more divergent seem to be the conclusions. Therefore, we shall look forward with very great interest to the results of this co-operative investigation carried on by the Dominion and Provincial Governments and continued for several years, in which investigation larger acreages have been treated and studied than has been done in the past. A number of results have been based upon the spraying of just a few trees, and as the work has shown, you cannot base any good conclusions upon any such restricted experimentation; therefore I think the Society is indebted to Mr. Ross and Mr. Caesar for bringing this matter before it.

FATHER LEOPOLD: What mixture did you use and when did you apply it?

PROF. CAESAR: I used three pounds of arsenate of lead to forty gallons of water, in which was one gallon of the cheapest molasses procurable.

A question for entomologists in this connection is, are you going to kill the bees? There was quite an agitation over the use of the sweetened mixtures this year. I used the mixture within fifty feet of a hive of bees. I also used the mixture for the grasshoppers on the same farm, and there was not a bee that came to the molasses so far as could be seen. Those of you who have read in the *Canadian Entomologist* the articles on fruit-flies will see it stated that if you use sugar for sweetening, the bees will feed upon the foliage where it is applied and you may have serious loss, but in the case of molasses they have not been known to do so. In the cherry orchards I kept a sheet spread underneath a tree, covering the whole surface beneath it and, tied to the branches all round, and I never found a bee on that. No bees were seen visiting the sprayed trees. The same thing is true of the work upon the apples for the Apple Maggot and of the grasshopper remedy. Further, I had one of the assistants at the College prepare this mixture and strew it along the ground—that is the grasshopper remedy—within twenty feet of the hives, to see if the bees fed on it. Only two lighted there, but quickly got up and went away. He then held it within a yard of them for nearly an hour. No bees went to feed. I have written to Kansas to Prof. Hunter and to Prof. Dean, and also to Prof. Parrott of Geneva, N.Y., and some others, asking for their experience in regard to the effect of the sweetened poison upon bees, and none of them report

any complaint. I am quite satisfied that there is no danger to the bees though at first I was certainly afraid as to what was going to happen.

Father Leopold has just asked me when you apply these mixtures for the Apple Maggot. *The first application should be made as soon as the adults begin to appear.* That is part of the secret of success. You will find that it will take about ten days for the adults to be sufficiently matured to lay eggs, and in that time they must be destroyed. Then there should be another application two weeks after the first. In Father Leopold's district it would be approximately the 15th July for the first application. The second application should come about the end of July. We applied the first on the 14th to 16th, and the second on the 2nd August. The adults emerge early in the warmer parts of the Province.

THE PRESIDENT: We are discussing the Apple Maggot, and as I do not think that it is a subject which will come up in any of the later papers so far as I can see, it is very important that it should be fully discussed at the present time. We are very glad to have with us to-day Prof. Brittain, Provincial Entomologist of Nova Scotia, in which Province the Apple Maggot has recently been discovered. I am sure you will be glad to hear from him a few words as to the occurrence of this insect in Nova Scotia. I should like to take this opportunity of heartily welcoming Prof. Brittain to our meeting, as I think this is the first one that he has attended.

PROF. BRITTAIN: It was not my intention to say anything about the Apple Maggot. Although I have done a little work this year, it is far too early to say much in that connection. We might however say something about its distribution. The main fruit belt in the Province of Nova Scotia consists of the Counties of Kings and Annapolis, which compose respectively the Cornwallis and Annapolis Valleys. We received a great many reports of the Apple Maggots being found in these places. One man reported that he was certain that he had it, but when we went out we found that it was the Green Fruit-worm. We had dozens of reports, but were never able to locate any manifestation of the Apple Maggot in the main fruit growing sections of Nova Scotia. On the other side, however, in western Annapolis and Digby County, and in the County of Hants, we have already located outbreaks. Late this fall I got a report that some of the insects had been found near Windsor in the Avon Valley, and we found there several orchards extremely badly infested. They were very small orchards and none were sprayed. We never found the Apple Maggot in the Province in an orchard which had been sprayed except in one case where we found two trees infested. The maggot is confined to those districts where very little spraying is done and no care is taken and where orchards are not considered important. In the County of Digby, no spraying is done, and there the insects are worst. Last year one of the inspectors found maggoty apples in Yarmouth County. He went back this year and was not able to find any although probably there were some present. Although we have found the maggot in several places we have not found it in Kings or eastern Annapolis. We found it in districts quite remote from each other. One inspector brought in some fruit from North Middleton, away in the north woods five miles from any dwelling of any kind, which were simply full of maggots. So that it looks as if this insect is not a new one but a pest of pretty long standing in the Province, but it has never been found in the best fruit counties. There has at least been no outbreak of any importance or we would have located it. Our inspectors visited every farm of importance this summer and we have been doing a little work in it of a preliminary character and received some results which are suggestive for further work. That is all we can say about it.

THE PRESIDENT: If there is no further discussion, that concludes the first part of our programme, the reading of the reports of the Directors. As Mr. Winn, our Vice-President is not here, I will call upon our ex-president, Dr. Bethune, to take the Chair while I read my Presidential Address.

PRESIDENTIAL ADDRESS.

C. GORDON HEWITT, D.Sc., F.R.S.C., DOMINION ENTOMOLOGIST, OTTAWA.

In welcoming you to the Fifty-first Annual Meeting of our Society, it is my sad duty first to call attention to the deaths, since our last meeting, of two of our former Presidents, one of whom was at the same time one of the founders of the Society, and both have placed us under a deep debt of gratitude by their devotion to the welfare of the Society and to entomology in Canada. I refer, as you will all know, to the deaths of Dr. William Saunders, C.M.G., LL.D., and to Mr. Henry H. Lyman, M.A. Worthy tributes to these two men have been written by a more competent hand than mine in the current volume of our journal,* but I should like to add a few words of personal appreciation.

*Henry Herbert Lyman, by C. J. S. Bethune, Can. Ent. Vol. 46, pp. 221-225. 1914. Dr. William Saunders, by C. J. S. Bethune, *Ibid* pp. 333-336.

HENRY HERBERT LYMAN.

The memories of the terrible disaster to the steamer "Empress of Ireland," on the 29th of May last are still acute in the minds of many of us who lost friends and knew the ship; I came out to Canada on her in 1909, and recrossed two years later. To me the feelings of horror were intensified by the fact that I had spent some time with Mr. Lyman on the afternoon of the 27th, when as your Delegate, he attended the meeting of the Royal Society in Montreal and read his report to that Society. His high sense of duty which characterized all his actions was particularly exemplified at that meeting. The afternoon was hot, the time available for receiving reports was very brief, and most of the delegates from Societies presented their reports by title. In view of these circumstances and for personal reasons, for he told me how unusually busy he was preparing for his departure to Europe, I strongly suggested to him that he should hand in his report to be read by title. But no, the report was read in the voice we all knew so well, and the meeting was informed of the manner in which we celebrated our Jubilee meeting. I believe the reading of that report was his last public act, and that I was the last entomologist who performed the duty of an ear for him and conversed with him by means of his scribbling pad; I cannot forget the happy banter of our conversation. He filled a unique place in our meetings, and in entomological meetings which he so zealously attended in other countries, and we shall miss his kindly presence and good-humoured impatience with those who, like myself, presented papers at the meetings without having prepared manuscript which his increasing deafness required as a substitute for the sound of the speaker's voice. At our Jubilee meeting we welcomed his charming wife, and our hope that his constant attendance at our meetings would by her assistance be assured will never be realized. (See Plate, page 8.)

William Saunders.

The illness which prevented Dr. Saunders from attending the Jubilee Meeting of our Society last year was responsible for his death in September last in his seventy-ninth year. I shall have occasion to refer to his influence on Canadian entomology in my address to you. Those of us who had the privilege of coming into close contact with Dr. Saunders, and of working with him, can understand the reasons for the successful development of all he undertook: his private business as a druggist, the progress of our Society and success of our journal *The Canadian Entomologist* in the early and more difficult days, and finally the organization and development of the Experimental Farms of the Dominion. The last will ever stand as a lasting monument to his enthusiasm and untiring industry. The significance of his work in connection with the development of Canadian agriculture has not been sufficiently recognized by Canadians generally. No man has ever done more, and no single man will ever have the opportunity which he had and of which he took the fullest advantage, to increase the production of the land in Canada. The value of such an accomplishment cannot be reckoned in terms of dollars and cents, it is inestimable; but it is appreciated by those who, in all countries, are striving towards the same ends.

We are concerned with him, however, as an entomologist. He was before all things a lover of nature, and his passion found an outlet in the study of insects and plants. In association with Dr. Bethune he marshalled the scattered workers of kindred tastes and our Society came into being. He was one of the first to realize the practical significance of entomological work, as our records show. In addition to the contributions to our Annual Reports he published in 1883 his "Insects Injurious to Fruits," which for many years was the standard work on the subject, and is now one of our entomological classics. When I undertook, five years ago, the organization of the Division of Entomology under his direction I had ample opportunity of appreciating his kindly thoughtfulness, and though he had grown out of touch with the modern developments of his old science, owing to the exacting demands of other branches of agriculture, his interest in the subject which he had done so much to advance in Canada never flagged, and his reminiscences were always full of interest. His career and industry should be an inspiration to all of us. (See Plate, page 6.)

I have chosen as the subject of my address:

APPLIED ENTOMOLOGY IN CANADA: ITS RISE AND PROGRESS.

Several reasons have guided me in the choice of the subject of my address as your President. Last year the Society reached the fiftieth year of its existence, and while our proceedings were enriched with delightful reminiscences of earlier years, no record was given of the gradual development in Canada of the economic or practical side of entomology, the growth of which has been so closely associated with the history of our Society. I have already referred to the loss during the past year of one of our founders, Dr. William Saunders, who, with the co-operation of Dr. Bethune, was largely responsible for the early development of our work. Moreover, it was my desire to pay a tribute to the work of these leaders in applied entomology in Canada by describing its growth and present status.

The economic aspect of entomology was first recognized "officially" in Canada in 1856, when the Bureau of Agriculture and Statistics of the Canada of that day,

which of course comprised only Upper and Lower Canada (Ontario and Quebec), offered three prizes of £40, £25 and £15 for the three best essays on "The Origin, nature and habits—and the history of the progress, from time to time—and the cause of the progress, of the weevil, Hessian Fly, midge and such other insects as have made ravages on the wheat crops of Canada; and on such diseases as the wheat crops have been subjected to, and on the best means of evading or guarding against them." The essay was to be designated by a motto. The first prize was won by Prof. H. Y. Hind, Professor of Chemistry at Trinity College, Toronto, whose "Essay on the Insects and Diseases Injurious to Wheat Crops" was published by the Government in the following year 1857, and was widely distributed to the farmers. Whether the agriculturists of that day were impressed by Prof. Hind's motto, history does not relate, but he selected the following extract from a speech of Napoleon III: "The progress of agriculture ought to be one of the objects of your constant care; for upon its improvement or decline depends the prosperity or decline of Empires." Even the suggested relation of insect pests to the decline of Empires did not produce any impression upon the mind of the Government of that day sufficiently great to induce it to do more than distribute the prize money—and the essays, for we have no record of any further official activity until about twelve years later.

Nevertheless, systematic entomology prepared the way for the permanent entrance into Canadian affairs of its practical sister. In 1863 our Society was organized as a result of the activities of the Rev. C. J. S. Bethune and Mr. William Saunders, and I have been fortunate enough to hear the story of its origin and early years from the lips of both of these sponsors, but this story is told elsewhere. It may be remarked, however, that the origin of the Society in Canada may be traced to the publication in the *Canadian Naturalist and Geologist* for June, 1862. of a "List of Entomologists in Canada" by these two gentlemen. This list contained the names of thirty-six persons interested in the study of insects.

The objects of the Canadian Entomological Society were: The formation of a collection of Canadian insects; the charge of a depository of duplicate specimens for distribution among members, and the holding of entomological meetings. It was inevitable that in the course of these mutual studies the members should be concerned from time to time with those species of insects which attracted the attention of other persons than entomologists, and insects of economic importance therefore received attention. In 1865 the Hon. George Brown engaged Dr. Bethune to edit the entomological section in *The Canada Farmer,* and for eight years information on injurious and useful insects was given through this medium to the farmers and fruit growers. Added stimulus to the investigation of the life-histories and habits of insects affecting the agriculturist was given by the determination of the Society five years after its foundation to publish an entomological journal *The Canadian Entomologist,* which came into existence in 1868 and soon began to publish articles of value to the practical entomologist.

The real birth of economic entomology in Canada, in my opinion, took place in 1869 when our Society received a grant of $400 from the Council of the Agricultural and Arts Association of Ontario, on condition that "the Society furnish an Annual Report and form a cabinet of insects useful or prejudicial to agriculture, and horticulture, to be placed at the disposal of this Council, and that they also continue to publish their journal." These conditions were readily accepted by the Society, and accordingly the "*First Annual Report of the Noxious Insects of the Province of Ontario*" was prepared in 1870 and published by the Provincial

Government of Ontario in 1871. It contained three papers on the insects affecting the apple, the grape and the plum, written respectively by Rev. C. J. S. Bethune, Wm. Saunders and L. Baynes Reed. Most of the insects were illustrated. Until a few months ago these pioneers were still with us. We are happy to know that Dr. Bethune is still able to carry on the duties of Professor of Entomology at the Ontario Agricultural College, Guelph, and that Mr. Baynes Reed, though he has transferred his attentions from insects to that still more elusive natural phenomenon, sometimes noxious, generally beneficial—the weather, takes a kindly interest in the work of his successors. The popularity of the first Canadian entomological report is evidenced by the fact that an edition of three thousand copies was soon exhausted.

Further government aid to Economic Entomology was received in 1871, when the Government of the Province of Ontario passed a statute incorporating the Entomological Society of Canada as the Entomological Society of Ontario, which was instituted for "the investigation of the character and habits of insects, the improvement of entomological science, and more especially its practical bearing on the agricultural and horticultural interests of the Province." A grant was made to the society by the Provincial Government, and the *"First Annual Report of the Entomological Society of Ontario"* was published. Without intermission that series of annual reports has been continued, and with the assistance of the government grant, which now amounts to one thousand dollars per annum, our Society has continued to render its services of increasing value not only to the agriculturists of the Province of Ontario but to the Dominion generally; and I feel that I must confess, my regret, which is shared by others whose interests are not confined to Ontario, that it was not possible to retain the old name of the Entomological Society of Canada, which the Society virtually is, as it has as affiliated Societies the Entomological Society of British Columbia and a branch in Montreal, and members are to be found in every Province.

Thus we trace the origin of applied entomology in Canada and find that the real stimulus to its development came from the agricultural society (The Agricultural and Arts Association of Ontario). In this connection it is of great interest to note in passing that applied entomology had a similar origin, which preceded ours, in the United States. First in the State of New York and subsequently in Illinois and Missouri the development of entomological work, with which the names of Fitch and Riley are associated, can be traced to the agricultural societies of these States.

We have seen that applied entomology in Canada had its genesis and official recognition in the Province of Ontario. Let us turn to the recognition by the Dominion Government of the fact that the study and control of injurious insects constitutes an integral factor in the development of agricultural and forestry resources of the country.

Development of Dominion Work.

In 1884 the Minister of Agriculture, (Hon. J. H. Pope), on the recommendation of a Select Committee, and in accordance with recommendations from different parts of the country, appointed a Dominion Entomologist; the position being an honorary one in the first year. Fortunately for the country there was at hand a man eminently suited to undertake such work, and the appointment of the late Dr. James Fletcher, at that time working among books in the Library of Parliament during the day, and among insects during his "spare" and happier moments, was a

most happy choice, for I have reason to know to what extent he endeared himself to all with whom he came in contact, and with what zeal he worked to create in the minds of the agriculturists an interest in insect pests and later, in farm weeds and other plants, for his work became of a dual nature. In 1886 the Dominion Experimental Farms were established, under the direction of an entomologist, the late Dr. Saunders, who continued their direction until 1911. As that was the only scientific branch of the Department of Agriculture at that time, and to increase his sphere of action, Dr. Fletcher was attached to the staff of the Experimental Farms Branch in the joint capacity of Entomologist and Botanist, a position which he occupied until his death in 1908. The uninterrupted series of Annual Reports which he published from 1884 until he died in harness testify to the infinite variety of problems with which he dealt.

Here I wish to digress a little, and in order to indicate in the words of one closely associated with him the character of Dr. Fletcher's work and the conditions which existed until the time of his death, I will quote the conclusion of Dr. Bethune's valuable paper on "The Rise and Progress of Entomology in Canada,"* written in 1898. Concluding a most interesting review of Canadian entomology he says: "Of one other name I must make special mention—that of our much esteemed colleague, Dr. James Fletcher. No one in Canada has done so much as he to instruct the people in a practical knowledge of their worst insect foes and the best means of dealing with them—but how strange it is that he should not be provided with adequate assistance. As Dr. Howard, President of the Association of Economic Entomologists of America well expressed it: 'Canada has the man and the knowledge, but has been hampered by want of funds. The result is that while she has immediately and intelligently adopted the results of researches made in the United States, she has not been able to lead us in original investigations.'" After describing the extent to which entomological work was supported in the United States, particularly at Washington, Dr. Bethune concluded: "Here in this vast Dominion of Canada we have only Dr. Fletcher, with merely one assistant, a secretary to help him in his immense correspondence, whereas he ought to have not only further help in Ottawa but also at least one competent entomologist under his direction in each province and territory from the Atlantic to the Pacific . . . . . It is earnestly hoped that this unsatisfactory condition may soon be rectified, and that entomology, especially in its economic aspect, may no longer be starved in their country, but with liberal aid may make more and more progress in its own field of work, and by its practical results justify all that may be done for it."

Following the death of Dr. Fletcher the entomological and botanical sections of his work were separated, and new Divisions of Entomology and of Botany of the Experimental Farms Branch were instituted. By my appointment as Dominion Entomologist in 1909 it fell to my lot to organize the new Division of Entomology, the staff of which consisted of Mr. Arthur Gibson, as Assistant Entomologist, and one clerk.

The next step in the development of the Dominion work was the enactment of The Destructive Insect and Pest Act in 1910. The San José Scale Act, passed in 1898, concerned itself with one insect only; under the Act ports of entry were determined for nursery stock and fumigation stations were established there. The threatened introduction of certain insects, particularly the Brown-tail and Gipsy Moths, made it necessary that the Dominion should have power to take steps to

*Trans. Roy. Soc. Canada, 2nd Ser., Vol. 4, Section IV; pp. 155-165. 1898.

prevent the introduction and spread of any serious insect pest. These powers were secured by The Destructive Insect and Pest Act, and since its enactment regulations have been passed which have as their direct object the prevention of the introduction of the San José Scale, the Gipsy and Brown-tail Moths, Potato Tuber Moth, Mediterranean Fruit Fly, and Woolly Aphis, and as their indirect objects the prevention of the introduction and spread of numerous other insects whose presence can be detected by inspection or death caused by fumigation. The passage of this Act enabled us to add to the entomological staff gradually a number of trained officers as Inspectors and Field Officers. Additional men have been appointed on the outside staff in connection with the next important development of the Dominion work.

With so extensive a territory to serve involving a great diversity of climatic, soil, topographic, and cultural conditions, with a pressing need for original investigations by trained men of our more serious insect pests in the regions where they occurred, involving the most important feature of all, namely, direct contact with the men whose problems we were studying and whom we desired to assist, an immediate extension of our work along definite and obvious lines was necessary; field or regional laboratories in different parts of the country were required. The first of these was established in the Niagara Peninsula in 1911 for the study of fruit insects. Additional field stations have been established each year until there are now nine stations from the Atlantic to the Pacific* each in charge of a trained entomologist, and the problems that are being studied cover the whole range of applied entomology.

The value of the work of the Dominion field officers in various parts of Canada cannot be overestimated. In most cases they are carrying on pioneer work, studying problems in provinces in which no previous entomological investigations have been carried on, and thus assisting in a most highly important manner in the development of entomological work in hitherto neglected fields. Such missionary work is undoubtedly the most necessary and at the same time the most valuable kind of endeavour to which our efforts can be devoted, and great credit is due to the men who are ploughing the virgin soil.

As a result of this development along special lines both in regard to administrative work and the investigation of entomological problems the Entomological Service was separated from the Experimental Farms Branch in April last and raised to the status of an independent Branch of the Department of Agriculture. The sanction of Parliament to increased appropriations, which are now more in accord with the needs of the country, is encouraging evidence of a desire to afford the means whereby the entomological service of the Dominion shall be in a better position to meet the requirements of the situation. Our greater ability to assist the agriculturists, foresters and others demanding our help in preventing the introduction of insect pests, and in controlling by natural and artificial means the spread of those already within our borders, has been the stimulating factor in our development, and I venture to think that the grounds for Dr. Bethune's earlier reproach which I have quoted have been already removed.

*The Dominion Entomological Field Stations are established at the following points: Bridgetown, N.S.; Fredericton, N.B.; Covey Hill, Que.; Vineland Station, Ont.; Strathroy, Ont.; Treesbank, Man.; Lethbridge, Alta.; Agassiz, B.C.; Vancouver, B.C.

The Development of Applied Entomology in the Provinces.

It is natural that the study of insects affecting agriculture, using the term as I do in its widest and inclusive sense, should develop early and make the most progress in these provinces in which agricultural methods and practice were most advanced. Accordingly, in tracing the early development of applied Entomology we have seen that it had its birth in Ontario, and forty years ago could be said to have been a sturdy though solitary infant. I now propose to trace the development and to give briefly the present status of applied entomology in the various provinces of the Dominion. We shall find that the impetus to the development of Entomological work in the provinces, as in the Dominion, has been largely due to the necessity of combating serious insect pests which have set foot in the country.

Ontario.

The early history of applied entomology in Ontario has been given, as it alone constitutes the earlier work in Canada. Such advances as were made on the science were entirely due to the activities of our society and of its members. When the headquarters of the society were removed to the Ontario Agricultural College additional stimulus was undoubtedly given to the work of the College in applied entomology. The Entomological Department of the Ontario Agricultural College has always combined with its function as an educator of the agricultural student the duty of assisting that wider circle of students, the farmers and fruit growers of Ontario, in solving their entomological problems. In this latter respect it has been virtually, and still is, the entomological bureau of the Provincial Department of Agriculture. This is certainly the case in so far as the investigations of insect pests and the assisting of the agriculturists and fruit growers are concerned.

Sheer necessity has also helped to develop the entomological work in the Province, and we shall find the same to be true not only in this Province, but in all the provinces in which the control of insect pests is undertaken by the Government, and the same applies to the Dominion. In fact, it is the outstanding feature of the origin of government entomological work that is forced upon the government from the outside usually by an exceptionally serious outbreak, or by the introduction or threatened introduction of an insect, the seriousness of which has been demonstrated by previous experience elsewhere. The most notable example is the San José Scale, which has been the original cause of most of the legislative measures in the United States and Canada.

Following the discovery of the San José Scale in Ontario in 1897, the Provincial Government passed an Act forbidding the importation of infested plants and providing for the inspection of orchards and destruction of infested trees. As a result of the drastic steps which were necessarily involved in energetically carrying out this Act opposition was created, but a Commission of Inquiry supported the policy of the Government, and a further Act was passed in 1899 providing for the fumigation of nursery stock and the inspection of nurseries. This work was at first under the direction of the Professor of Entomology at the Ontario Agricultural College (then Prof. Wm. Lochhead), whose skilful management did much to prevent the spread of the scale in those early days. The Fruit Pest Act was passed in and was amended in 1912. This Act is administered by the Fruit Branch of the Ontario Department of Agriculture. So that the entomological work is now

carried on jointly by the Fruit Branch and the Entomological Department of the Agricultural College, whose teachers direct the work of the inspectors in addition to carrying on the educational and investigatory work in the Province. In 1912 the very necessary step of appointing a Provincial Entomologist was taken, and Mr. Lawson Caesar, who had carried on for several years the duties of such an office with commendable zeal and success was appointed to the position. His recent promotion to be Associate Professor of Entomology in the Agricultural College is a deserved reward for the excellent practical work which our fellow member is carrying on. I have no hesitation in saying that the provincial entomological organization in Ontario, under Professor Caesar, who directs an excellent staff of inspectors, will not suffer from comparison with similar services in the states to the south of us.

British Columbia.

As early as 1887 the Rev. George W. Taylor, whose subsequent reputation as an entomologist was by no means confined to this country, was appointed Honorary Provincial Entomologist of British Columbia, but I am inclined to believe that the duties were more along the lines of systematic than applied entomology. Owing no doubt to the fact that a considerable proportion of the people who settled in the Pacific coast province came out from England, and because of the rich and attractive insect fauna which was discovered there, we find that entomology has always had a number of zealous devotees in the province, among whom may be mentioned the names of Taylor, Harvey, Hanham and Day. In spite of the temporary suspension in 1908 of the activities of the British Columbia Entomological Society, which was started in 1901 and affiliated with out society in 1905, the interest in entomology did not die out, for the society was resuscitated through the energetic efforts of Mr. R. C. Treherne in 1911.

During this period a change in the public estimation of entomology in the province has been brought about. Formerly it signified the collection of insects and their study; now it involves not only this systematic aspect but a consideration of the practical bearing of insect life upon human activities. I have no hesitation in saying that with the co-ordination of these two independent sections of entomological work entomology in British Columbia has a firm establishment, and the present growing society will not suffer the fate of the former society, which had not the same amount of human interest in the subject.

For this entomological revival in British Columbia much credit is due to Mr. Treherne, who, as an officer of the Dominion Entomological Service, was sent out to take charge of the work in that province in 1911, and in 1912 commenced a series of investigations at the Dominion Entomological Field Station established that year at Agassiz.

The applied entomological work of the Provincial Government has, until a year or two ago, taken the form of the administration of legislation having for its object the prevention of the introduction of insect pests into the province. Great praise is due the Province for its activities in this important direction. Following the organization of the fruit-growers about twenty-five years ago, the Provincial Government passed the Horticultural Board Act in 1894, under which a Provincial Inspector of Fruit Pests was appointed. This officer's duties were somewhat extensive; they were educational, in that he was required to "hold meetings throughout the Province in the interests of horticulture and impart such information and

instructions to fruit-growers and farmers as may tend to the improvement and expansion of the fruit industry of the province." In addition (and this, as this title would indicate, has proved to be the chief duty of the officer), the Inspector of Fruit Pests was required to carry out the Board's regulations relating to the prevention of the introduction and spread of insect pests and plant diseases. The first inspector was Mr. R. M. Parker. It is largely due to the zeal and extraordinary enthusiasm of the present Inspector of Fruit Pests, Mr. Thomas Cunningham, that the Province is so remarkably free at the present time from such orchard insects as the Codling Moth and San José Scale, to mention the most important, when other newly-developed regions have succumbed to their invasion. The work is now carried out under the Agricultural Associations Act of 1914. Formerly the fumigation and inspection of imported nursery stock and plants was carried on by the Dominion and Provincial Governments at Vancouver, but the duplication of work which necessarily followed has been abolished by an arrangement whereby compliance with the Dominion regulations is effected by the Provincial Inspectors of Fruit Pests under the supervision and with the co-operation of the Dominion Department of Agriculture, and the system is working admirably.

In passing, mention should be made of the entomological work of Mr. J. R. Anderson, formerly Deputy Minister of Agriculture, who has always been a keen observer and has assisted in the development of applied entomology in the Province. His bulletin on "Farmers' Foes and Their Remedies," published in 1908, has done much to create an intelligent interest in the subject of insect pests in the province.

In the spring of 1912 Mr. W. H. Brittain was appointed Provincial Entomologist and Plant Pathologist under the Fruit Branch of the Department of Agriculture, but his removal to Nova Scotia in 1913 caused a cessation of the investigations on fruit insects which he had started, and which, with those carried out by the Dominion Field Officer, Mr. Treherne, constituted the first serious efforts on the study of practical entomological problems in the province.

I should include in this statement the investigatory work of Dr. Seymour Hadwen, of the Health of Animals' Branch of the Dominion Department of Agriculture, who in the course of his study of animal diseases has been able to carry on entomological work on insects affecting live stock, which studies have been productive of excellent results, his work on the Warble flies (*Hypoderma* spp.) and ticks being particularly important.

The provincial entomological work, apart from the inspection work under the Provincial Horticultural Board, is being carried on at present by the Provincial Plant Pathologist, pending, I venture to hope, the appointment of a Provincial Entomologist, upon whom will devolve a large amount of highly important work as British Columbia has many problems peculiar to itself.

Nova Scotia.

Although Nova Scotia is one of our oldest provinces where educational facilities have always been exceptionally good, we do not find any early development of practical entomology; indeed, the number of collectors in the province has never been so great as one would expect. From the establishment of the Provincial Agricultural College, Truro, until 1912, Prof. H. W. Smith, Professor of Biology, undertook any local entomological work that might be required, such as replying to enquiries regarding the control of insect pests, chiefly those affecting fruit, and

attending meetings of fruit-growers and agriculturists. He also contributed articles on applied entomology to the *Annual Report of the Provincial Department of Agriculture.* In 1900, following the activities of the Dominion and Ontario Departments of Agriculture, the Provincial Government passed a San José Scale Act, but no enforcement of the provisions of the Act were required.

The necessity of possessing wider powers, indicated by the introduction of the Brown-tail Moth, led to the passage of the Injurious Insect Pest and Disease Act in 1911. This Act was more comprehensive and enables the Provincial Department of Agriculture to appoint inspectors and to take the necessary steps to prevent the introduction of and eradicate insect pests. This measure was passed none too soon, for in 1912 Mr. G. E. Sanders, of the Dominion Entomological Service, discovered San José Scale in the province, into which it had been introduced on nursery stock from Ontario. It is an ill wind that blows no one any good, and again the discovery of a serious insect pest led to necessary progress in applied entomology. Not only did the Nova Scotian Government appoint a Provincial Entomologist in 1912, in the person of Dr. R. Matheson, but the Ontario Government recognized the need of such an official to have charge of the nursery inspection. Dr. Matheson organized an inspection service, and it is largely due to the energetic measures taken by him in eradicating infested trees that the Scale has been pratically exterminated in the Province. Dr. Matheson returned to Cornell University in 1913, and was succeeded by Mr. W. H. Brittain, who now occupies the position of Provincial Entomologist and Professor of Entomology in the Provincial Agricultural College.

In addition to the San José Scale inspection work carried on by the Provincial Department of Agriculture, the Province co-operates with the Dominion Department of Agriculture in the work against the Brown-tail Moth, for which work the latter Department is responsible, by supplying an equal number of inspectors to those employed by the Dominion.

The prospects for applied entomology in the Province are unusually bright; there are many important problems awaiting solution and much educational work is necessary. Already the joint efforts of Mr. Brittain and the Dominion Field Officer, Mr. G. E. Sanders, who has charge of the Brown-tail Moth work in the Province, have had a marked effect, particularly in the direction of increased efforts on the part of the fruit-growers, not only to control insect pests but to do so intelligently.

Quebec.

While insect pests have not spared the fields and forests of Quebec during its development, the progress of ideas in regard to the scientific control of insect pests has been slow. Although the Abbé Leon Provancher was a most industrious student and a prolific worker on the insects of Quebec, he did not concern himself with the practical application of entomological knowledge, but confined his attention to the collection and classification of insects of the Province, in which work he persevered in spite of lack of access to literature and other collections. The results of his efforts are evident in the pages of "*Le Naturaliste Canadien,*" which he founded in 1869, and in which he commenced his "Faune Entomologique du Canada" in 1874, which he completed in 1890, two years before his death.

Prior to the establishment of Macdonald College, in 1907, and the location of a Dominion Entomological Laboratory at Covey Hill, Que., in 1912, I do not know of any investigations on insect pests. For a number of years, however, Mr.

J. C. Chapais, of St. Denis en Bas, has taken advantage of his journeys through the Province as Assistant Dairy Commissioner for the Dominion Department of Agriculture to disseminate useful information regarding the control of insect pests affecting agriculture, and his pioneer work in this direction is deserving of much credit.

Valuable educational work was also carried on in the Province, particularly in the Eastern Townships, by the Rev. T. W. Fyles, who, in 1880, was awarded a prize by the Missisquoi Agricultural Society for an essay on "How to Guard against the Ravages of the Potato Beetle, Locust, etc.," which was subsequently published in the Provincial *Journal of Agriculture.* By his charming popular writings and exhibits of insects he has done much to create an interest in entomology in the minds of those who would be benefited by its practical application. As a society we are pleased that, in spite of his increasing years, he is still able to take part in our deliberations and to contribute to our Proceedings.

The establishment of the MacDonald College, at St. Anne's, in association with McGill University, brought Prof. Wm. Lochhead and a staff of enthusiastic workers who have taken the most prominent part in the arduous task of developing the study and practice of applied entomology in the Province. In 1908 Prof. Lochhead founded the Quebec Society for the Protection of Plants from Insect Pests and Fungous Diseases, which receives a grant from the Provincial Department of Agriculture to enable us to carry on the valuable and very necessary educational work in the Province. The wide range of subjects and useful character of the practical information contained in the six annual reports of the Society which have been published up to date indicate the important part it is playing in the development of applied entomology in the Province.

The Department of Agriculture of Quebec realising the necessity of safeguarding the interests of its nurserymen and fruit-growers appointed a Provincial Entomologist in 1912, the Abbé V. A. Huard, Curator of the Provincial Museum at Quebec, and editor of "*Le Naturaliste Canadien,*" being selected for the position and in 1913 an Act was passed providing for the inspection of nurseries and giving the Provincial Entomologist the necessary powers to make such inspections and issue certificates. We are looking forward with interest to the development of the practical side of entomology under the Provincial Department of Agriculture, the Fruit Branch of which is displaying commendable activity in connection with their work in demonstration orchards.

Before this review of work in Quebec is closed reference should be made to the educational work that is being carried on in certain of the educational institutions in which, as our correspondence indicates, there is a growing interest in entomology. Particularly should the energetic efforts of Father Leopold, of the Trappist Agricultural College at Oka, P.Q., be mentioned in this connection, as his influence will be widespread in directions in which information on the scientific control of insect pests is sorely needed.

New Brunswick.

For a number of years Mr. Wm. McIntosh, Curator of the New Brunswick Natural History Society's Museum at St. John, N.B., has carried on pioneer work of an educational character in the province, particularly in the schools, and he has assisted the Provincial Department of Agriculture in entomological matters from time to time. Particularly valuable has been his educational work since the estab-

lishment of the Brown-tail Moth in Canada. The work of Mr. R. P. Gorham, Assistant Horticulturist in the Provincial Department of Agriculture, is also deserving of mention.

Since the field work against the Brown-tail Moth was commenced in the Province by the Dominion Entomological Service in 1911, the Provincial Department of Agriculture has co-operated in the work by providing half the staff of inspectors required, this excellent plan being followed in both the infested provinces, Nova Scotia and New Brunswick. A further necessary step was taken by the Province in 1913, when an "Injurious Insect and Pest Act" was passed giving the Provincial Department of Agriculture powers to take the necessary steps to prevent the introduction and spread of serious insect pests and plant diseases.

Manitoba, Saskatchewan and Alberta.

In the three prairie provinces the agricultural conditions are probably responsible for the fact that, except for occasional serious outbreaks of locusts or cutworms which have been of the usual duration, there has been no insistent demand for entomological work. With the adoption of more diversified methods of farming and the necessity of increasing the production and discontinuing "mining" the soil, greater attention must be paid to the methods of insect control. The farmers in these provinces have looked to the Dominion Department of Agriculture for assistance and have been well served. The establishment of field stations in southern Manitoba and southern Alberta for special investigations indicates the intention of the Dominion Government to assist the agriculturists of the West. Notwithstanding the fact that no official Provincial Entomologists have been appointed in the prairie provinces, there are a number of men who have had a marked influence on the progress of applied entomology in that important section of the country.

In Manitoba Mr. Norman Criddle has studied the native injurious insects for many years. His work first came to the notice of Dr. Fletcher in 1901. Not only has he become widely known to the farmers of Manitoba through his contributions to the agricultural press, but his investigations have been productive of results of practical value. His remedy for locusts, now well known as the "Criddle Mixture," has proved of immense value. His appointment in the Dominion Service to carry on investigations in Manitoba is a deserved recognition of his ability, and an important step in the direction of assisting the grain growers in the control of insects affecting cereals. Prof. F. W. Brodrick, Professor of Horticulture at the Manitoba Agricultural College, Winnipeg, Man., has also taken a keen interest in entomological work, and he and Prof. V. W. Jackson, Professor of Botany, have done much to extend a knowledge of the control of insect pests among the students and agricultural community in the province. I understand that the establishment of an Entomological Department in the Agricultural College, with a competent man in charge, is contemplated; such a forward step would be in every way desirable and justified.

Throughout Saskatchewan the name of Mr. T. N. Willing, Associate Professor of Natural History in the Saskatchewan Agricultural College, Saskatoon, is known for his educational work among the farmers. By lectures at Institute meetings and exhibits of injurious and beneficial insects he has performed a real service to the agricultural community. Previous to his present position Mr. Willing held the position of Chief Inspector of Weeds for the Department of Agriculture in Sas-

katchewan, and combined with the botanical work such entomological propaganda as he was able, all enquiries respecting the control of insect pests being referred to him.

In the Province of Alberta there existed some years ago the North-West Entomological Society, which had for one of its objects the dissemination among the agriculturists of information relating to the control of insect pests, and its President, Mr. P. B. Gregson, of Waghorn, was particularly active in this aspect of the Society's work. I do not think the society exists at the present time, although there are several entomologists in the province, of whom Mr. F. H. Wolley-Dod is well known on account of his work in Noctuidæ. The Provincial Department of Agriculture of Alberta has not taken any steps in the direction of educational or other work regarding the control of insect pests.

No action has been taken by the Provincial Government of Prince Edward Island regarding entomological work.

In briefly touching upon the various phases of the progress of applied entomology in the provinces nothing has been said concerning a number of agencies not entomological, all of which have helped in the general development of entomological work among the agriculturists. Such agencies are the Farmers' Institute meetings, agricultural fairs, demonstration orchards, district representatives, the more recent "Better Farming" special trains; all of these varied activities, through the zeal of those who have charge, have and will have in an increasing measure a potent influence in developing our science.

No one is more conscious of the rambling nature of the foregoing account than its writer, but if the description appears to lack co-ordination, like the solitary efforts of those who have been the pioneers in our work in Canada, you cannot fail to observe the single motive which runs through all the efforts—an unquenchable desire to place scientific knowledge at the disposal of those who will profit by its application to the advantage of the country at large. Entomologists are sometimes wont to resolve themselves into two main classes: the systematists, who collect and classify, and the economic entomologists, who study how to control species affecting man in his varied activities. Occasionally I have heard the former section speak somewhat disparagingly, even scornfully of those who apply their knowledge to every day life; on the other hand, a reversal of such opinions is sometimes heard. We need not concern ourselves with the opinions of those who collect insects as they would stamps or china, but I would remind those systematists who are inclined to hold aloof from the practical application of their science that to the work of economic entomologists they owe almost entirely that large measure of respect with which entomologists and entomological work is now regarded by the general public. The prevention and eradication of diseases carried by insects and the control of insects which have devastated our forests and crops and depopulated whole districts is regarded as work indispensable to national development. Such work has led people to appreciate the value of entomological work to humanity at large, and incidentally to recognize that there is no ground for the assumption that a man with a net is to be pitied, or, as in one instance that came to my knowledge, confined to the local gaol as insane. Applied entomology is, as its name applies, science with practice. It was preceded by the study of the science for its own sake, and such a study must necessarily furnish the basis for all entomological work that is to be of practical value. The pioneers of applied entomology in Canada were all men who loved the science of entomology primarily for its own sake, and not on account of the practical value of the knowledge they

gained regarding insects. When they were able to put their knowledge to a practical purpose and to take up its application they did so with untiring zeal. This is the lesson taught by a study of the subject of my address, and in directing your careful attention to it I would urge the necessity of our emulating the example of the founders of applied entomology in Canada. Let it be our constant endeavor in developing the work of our society and of our work in Canada to recognize the need of, and endeavor at all times to secure the closest co-operation between the man who collects and studies our insects for the mere pleasure of gaining the wonderful and unequalled insight into nature that it gives and the man whose studies lie in the laboratory and in the field and forest. With such co-operation there can be no doubt as to the place which entomology in Canada will occupy.

Dr. Bethune: We have all, I am sure, listened with the greatest possible interest to the admirable address which Dr. Hewitt has just given us. It is certainly the most complete and exhaustive history of the rise and progress of economic entomology which has yet been prepared in this country, and I think we all must feel that we owe a very hearty vote of thanks to Dr. Hewitt for his successful efforts in this respect. Dr. Hewitt has come in at the end of the first period of history in this respect, and we may look to him with the greatest confidence to carry on and develop to a far greater extent than we who belong to the earlier period ever dreamed of, this work of economic entomology in Canada, and to mature the systematic side as well. The two cannot exist satisfactorily away from each other, and there must be this co-ordination to which he has referred in order that we may have success in both directions and in the important field of economic entomology.

Dr. Fyles: We have all listened, I am sure, with the greatest pleasure to the able and stimulating address that Dr. Hewitt has given us, and we all feel, I am sure, that the Government has the right man in the right place. It is indeed a great thing to have a man who brings it before us in such an able way, and urges men to carry on works which are now being undertaken to develop practical entomology as Dr. Hewitt has done. I am sure we all feel that he is entitled to our warmest thanks, and while we feel this, at the same time it is a great pleasure to us to see our friend Dr. Bethune, our old President, the Editor of our paper for so long a time, present amongst us and occupying the chair, and while we are sorry that several old friends have passed away, as some of our dear friends have lately done, it is a source of rejoicing that we still have Dr. Bethune amongst us. Long may he continue his services to the Entomological Society of Ontario. We are glad to see younger men coming up and doing the work in such an able way as so many of the younger men are carrying on the work in distant parts of the country for the general good. I beg to second the vote of thanks that Dr. Bethune has proposed to Dr. Hewitt, and hope that he may long continue his work with his able assistant Mr. Gibson. If you go to the new apartments of the Department of Entomology in Ottawa, and go upstairs in one of the towering buildings which men are putting up in these days, you will find large rooms there devoted to our favourite science, and there you will find Dr. Hewitt and Mr. Gibson ready to afford you all information in their power and to show you very valuable collections that are there gathered.

The President: I thank you all for your very cordial and most encouraging reception of my paper and for Dr. Bethune's and Dr. Fyles' encouraging words, and I only hope, as I endeavoured to show in my paper, that it is upon the wonderful example of our founders, particularly that of Dr. Bethune, that we are basing our efforts, and hope as best we can to follow that example in the development and progress of our work in Canada.

INSECTS OF THE SEASON IN ONTARIO.

L. Caesar, O.A. College, Guelph.

Orchard Insects.

Most of our common orchard insects, such as Codling Moth, Plum Curculio, Bud Moth, Case-bearers, Blister Mite, Round-headed Apple-tree Borer, and Pear and Cherry Slugs have scarcely done so much damage this year as usual; at any rate, no complaint of difficulty in keeping any of them under control has reached me.

Tent-Caterpillars (*Malacosoma americana* and *M. disstria*) were again abundant in the eastern part of the Province, and the former has spread westward throughout a large part of the Province. In the east, however, neither species was quite so numerous as usual, and, according to the reports of district representatives and others, many caterpillars died before pupating, indicating probably that they were attacked by disease. In July, I examined numerous cocoons of *disstria,* the more common species, and observed that 90 per cent. of them were

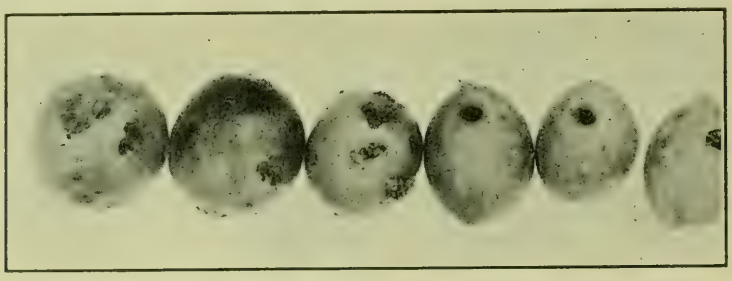

Fig. 3.—Work of Plum Curculio (*Conotrachelus nenuphar*).

infested by a tachinid larva. There are fewer egg masses of both species this fall in the east than last year, and many of these masses have the surface roughened as if injured in some way. It is probable that the long siege of Tent-caterpillars is about at an end. Lime-sulphur applied as the eggs are hatching proved once more an excellent remedy, even without any poison.

San José Scale (*Aspidiotus perniciosus*). The last two seasons with their long warm autumns have given the scale a wonderful chance to increase rapidly in infested orchards. This pest has not, however, so far as known, spread much since our last report, though it has been found in several new places in districts where we suspected it might be. A more vigorous campaign than ever is being carried on against the pest. The chief trouble in control is to get trees thoroughly sprayed.

A large number of parasites were imported in September from Pennsylvania and were distributed in various places in Niagara district and in Essex County. More will be forwarded from the same State next spring. Seven small twigs, averaging 4½ inches long and ⅕ of an inch in diameter, were reserved and placed in breeding jars. Parasites continued to emerge for one month from date of sending. About 80 individuals were obtained, nearly all of these being *Prospaltella perniciosi,* Tower. It is hoped, therefore, that a large number of these parasites have become established in the orchards, especially as the weather was warm and fine for considerable time after they arrived.

Aphids. The injury from these has, on the whole, probably not been so great as usual, but there have been some exceptions. It seems that orchards and nurseries situated near the great lakes and influenced by the moist, cool breezes are much more severely infested than those further inland. In the control of aphids 10 lbs. soluble sulphur and 4 lbs. common laundry soap to 40 gals. water, applied as soon as the eggs have all or almost all hatched, promises to be the cheapest remedy. This will burn if the buds have opened and the leaflets appeared. Black-leaf 40 and lime-sulphur is also good but more costly.

Apple Curculio (*Anthonomus quadrigibbus*). Injury to apples from this insect can be found here and there all over the Province. It seems to be worst in the eastern part. One orchard at Mountain, twenty-five miles from Ottawa, showed in September, 50 per cent. of the Tolman Sweets deformed by punctures. Doubtless many more apples had dropped off early in the season.

Capsid (*Neurocolpus nubilus*). The nymphs of this Capsid were found on June 16 in large numbers in a forty-acre orchard in Norfolk County attacking

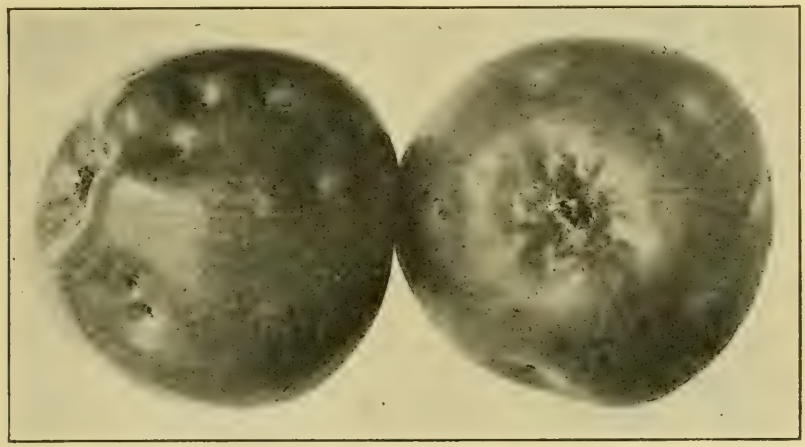

Fig. 4.—Work of Apple Curculio (*Anthonomus quadrigibbus*).

a block of Spy trees. Approximately 50 per cent. of the apples were attacked, though some of them were not permanently injured. At this date the apples were about two-thirds of an inch in diameter, so that they had reached the stage where the nymphs were ceasing to feed on them and were attacking the tender leaves and stems of shoots from main branches and of the suckers that sprang up from the crown. This part of the orchard was in grass but it is not probable that this accounts for the presence of the pest. In 1912 I reported a similar injury from this species to Spy apples at Woodburn, not far from Grimsby.

The nymphs are light green, interspersed with brown or reddish brown. The antennæ are very conspicuous. They are longer than the body, reddish brown with alternating broad white rings. The occurrence of numerous black capitate hairs give to the second joint especially a swollen appearance. The adults are about the size of the Tarnished Plant Bug (*Lygus pratensis*) but are somewhat longer and narrower. The general dorsal colour is brown mottled with black with a reddish area near the costal margin of the upper wing just in front of the membrane. The antennæ are longer than those of *L. pratensis*, and have the basal segment longer, thicker, and covered with black capitate hairs.

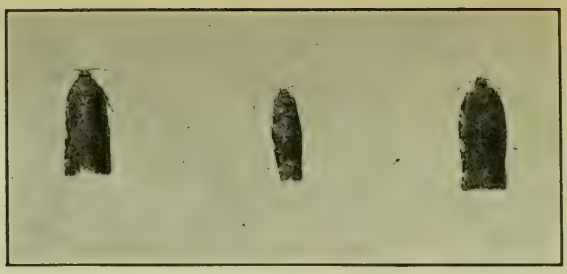

Fig. 5.—Moths of Fruit-tree Leaf-roller (*Archips argyrosphila*), about natural size.

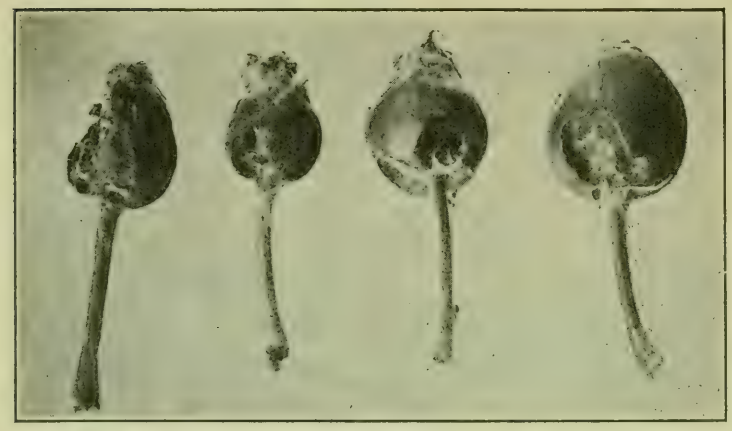

Fig. 6.—Work of Fruit-tree Leaf-roller on Young Apples, natural size.

Fig. 7.—Work of Fruit-tree Leaf-roller on Apple Foliage.

FRUIT-TREE LEAF-ROLLER (*Archips argyrosphila*). In the above Norfolk orchard, and in the very same part of it, the Spy apples were severely attacked by this leaf-roller. The insect did not confine its attack to the fruit but riddled numerous leaves as well, especially all over the top of the trees. It was estimated that at least 40 per cent. of the apples had been injured. The larvæ feed on the fruit from the time it begins to form until it is about two-thirds of an inch in diameter. Irregular holes are eaten into it, and, when these callous over, they leave the apple badly deformed in many cases.

In our cages the moths began to emerge the third week in June. In the orchards in the eastern part of the Province moths were seen as late as July 17th. Eggs are laid in small brown clusters on the twigs and evidently hatched in Norfolk about the time the blossoms fell from apple trees. The winter is passed in the egg stage. There is only one brood a year. The insect has been found in such widely distributed portions of the Province that it is now present probably in all or nearly all the apple districts. In several localities in New York and several other States, it has caused serious loss to apple growers. It is a very difficult pest to combat as the ordinary Codling Moth spray does not control it. Possibly heavy applications of double strength arsenate of lead would do so. Experiments by the Washington, D.C., investigators indicate that these give moderately good results. We need not be surprised if there are several serious outbreaks next year as there are many eggs, at least in the Norfolk orchard.

PEAR PSYLLA (*Psylla pyricola*) was abundant in a few orchards while nearby orchards had almost none. The time of spraying probably accounts for the difference.

GRAPES AND BUSH FRUIT INSECTS.

GRAPEVINE FLEA-BEETLE (*Haltica chalybea*). This beetle was more common and injurious to the bursting buds this year than I have ever seen it before.

ROSE CHAFER (*Macrodactylus subspinosus*). There were probably on the whole about the usual number of these beetles but at Fonthill in a neglected vineyard they were so abundant that almost all the grape clusters were destroyed.

BLACKBERRY LEAF-MINER (*Metallus bethunei*). This insect has been referred to several times in reports as infesting severely Blackberry leaves. A few weeks ago Dr. McGillivray stated in the "*Canadian Entomologist*" that it was a new species and gave it the above name. The life history, as observed, is as follows: The winter is passed in the larval stage in the ground an inch or so below the surface in a small oval earthen cocoon. Adults appear in July and lay their eggs beneath the epidermis of the leaves. The larvæ from these become mature early enough for a second brood, some larvæ of which may be found in the leaves even up into November. The insect does not seem to be so abundant this year as usual.

THE RASPBERRY SAWFLY (*Monophadnoides rubi*) was very common in Niagara this year.

THE CURRANT STEM GIRDLER (*Janus integer*) was found at St. Catharines by my assistant, Mr. J. Shipton. This little known insect has now been reported from Lambton, Wentworth and Lincoln Counties. It has not done a great deal of damage anywhere, so far as known.

VEGETABLE, CEREAL AND FODDER INSECTS.

THE PEA APHIS (*Macrosiphum pisi*) has caused much injury to late peas, especially in Prince Edward County and the counties along the southern part of Lake Huron. Early peas in most cases escaped.

THE ARMY WORM (*Heliophila unipunctata*) which was so abundant this year, has been dealt with by Mr. Baker in a separate paper.

GRASSHOPPERS (*Melanoplus atlanis, M. femur-rubrum,* and *Camnula pellucida*) were very abundant in a number of localities, especially in old pastures and waste places. The new Kansas remedy was used with excellent results and can be highly recommended. Results should not be looked for until two or three days after the application. Beekeepers feared injury from this sweetened poison, but field observations and experiments showed their fears were not justified.

GARDEN AND GREENHOUSE INSECTS.

MILLIPEDES. The last few years an increasing number of complaints of injuries to garden plants from these have been sent in. It would be a boon to learn of any simple and effective remedy.

TARNISHED PLANT-BUG (*Lygus pratensis*). This insect is a great foe to growers of dahlias as it punctures and destroys the blossom buds. A remedy is badly needed.

THE GREENHOUSE LEAF-TIER (*Phlyctænia ferrugalis*). The caterpillar of this small brown moth seems to be quite abundant in some greenhouses, and so far as my experience goes, is most common on Chrysanthemums, the leaves of which it ties together and feeds upon.

ROSE LEAF-HOPPER (*Typhlocyba rosæ*). It is remarkable how many roses have their foliage injured by this little pest. Tests with soluble sulphur—2 lbs. to 40 gals. water—and with lime-sulphur, 1.010 specific gravity, and also with Black-leaf 40 and a small quantity of soap, showed that any one of these would control the pest if applied in May before the nymphs had become full grown.

FOREST AND SHADE TREE INSECTS.

THE BRONZE BIRCH-BORER (*Agrilus anxius*) has during the last two seasons destroyed many beautiful European Cut-leaved Birches in the neighbourhood of Guelph.

Cryptorhynchus lapathi is in several parts of the Province doing much injury to some species of swamp willows, and in some cases to some of the so-called weeping willows on lawns.

THE EUROPEAN FRUIT-LECANIUM (*Lecanium corni*) has again become very abundant, especially in a number of forest trees. It is, however, becoming heavily parasitized.

THE COTTONY MAPLE SCALE (*Pulvinaria vitis*) was abundant on soft maples at Guelph this autumn, but is heavily parasitized by *Coccophagus lecanii* Fitch.

ADDENDA.

GLASSY CUTWORM (*Hadena devastatrix*). Since writing the above, specimens of this cut-worm have been sent me from Grey County with the statement that much damage is being done to winter wheat in fields that were not ploughed early but late, or comparatively late. The larvæ at this date (November) are for the most part, about one inch long, though a few are an inch and a half.

PROF. CAESAR: I should like to hear from Prof. Crosby on the Tarnished Plant Bug, and how to control it.

PROF. CROSBY: In regard to the Tarnished Plant Bug, in Rochester where it is a great pest in nursery stock, I think that in that region at least, the injury to peach buds is caused almost entirely by this insect, though in other portions of the country it may be caused by something else. I have never been able to find there a mite doing any perceptible injury. We worked on this question last year, and the results were published in the winter. This summer we continued our work with the same results as before. We did not succeed in doing anything to prevent their injury or destroy the bug. This summer we surrounded a portion of the peach block with a six foot wire screen fence of the ordinary mesh

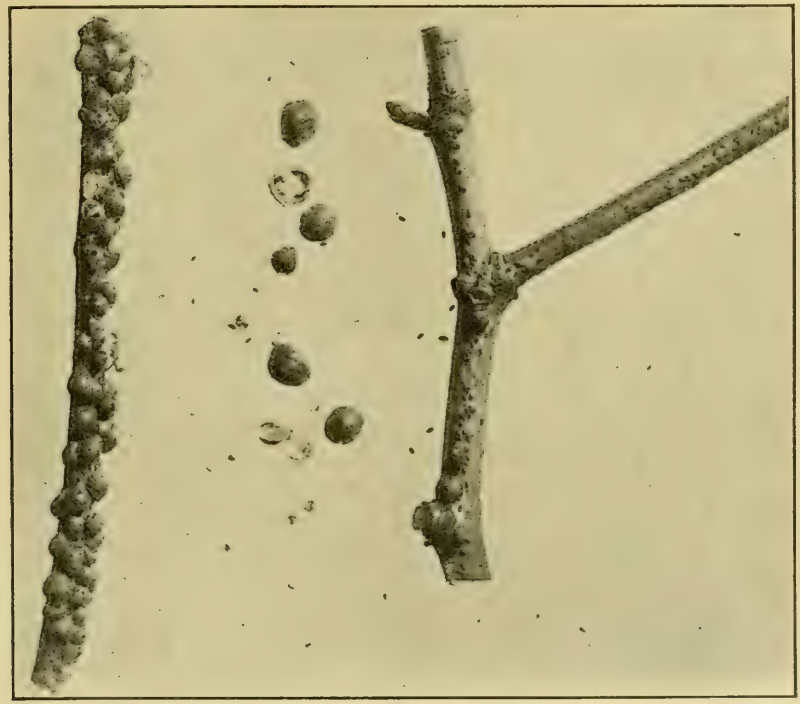

Fig. 8.—European Fruit Lecanium Scale (*Lecanium corni*). On the left are the full-sized scales, some of them with holes from which parasites have emerged. On the right is the winter stage of the scale. The tiny scales or specks in the centre are also winter stage that were removed from the twig. Note the small size of this stage compared with the adult scale.

we have on windows. A few observations we made last year led us to believe that they would not fly over such a fence to any extent. We also put a band of tanglefoot round the top. We found that a great many would walk over the tanglefoot quite easily while other insects got caught. Some flew over. There are many high winds there, and by the end of the season of injury, which was about the middle of July, there were as many stung nursery trees inside the fence as outside. We also had the idea of putting paper bags on the top of the trees to prevent injuries. We had to put the bags on so early in the season that the trees were too tender and would bend over with the weight of the bags. That had to be abandoned. Finally we thought we might be able to help the trees overcome the injury by a system of summer pruning. The results of this

have not been ascertained yet. I do no not think that we have as yet found any practical means of preventing in any way the injury from this insect to peaches. In the matter of injury to asters, we found that when grown in the shade of apple trees in old orchards, they would give the best results.

PROF. CAESAR: I think it would be very interesting if we were to hear from Prof. Brittain in regard to the Capsid attacking the apples down in Nova Scotia.

PROF. BRITTAIN: Last winter when I was going round the Province, everybody was asking me what caused the woody pears. Some said it was due to the iron in the soil or something or other which made their appearance woody, so that when one tried to eat them it hurt one's teeth. I did not have the slightest idea then what they meant, but this is what it was. These are pears that are affected by a plant bug which has been determined as *Lygus invitus,* the False Tarnish Plant Bug. They were extremely numerous in Nova Scotia this year, and caused immense damage to apples and pears. In pear orchards the injury is more conspicuous, because they cause quite a good sized corky area to appear on the surface of the pears, and this corky area or hard woody area extends into the pulp, and makes it unfit for eating as well as unsightly. When the pears are first punctured, a little drop of exudate oozes out, and finally the injury becomes larger and hard and woody, rendering the pears unfit for human consumption. If the apples are attacked when small they invariably drop to the ground, but if attacked a little later there is considerable malformation and the fruit is no good. It also works on the tender growing shoots. When the insect stings these shoots and the growth takes place rapidly, it makes large marks. It is hard to realize that it is possible for the marks to be caused by the puncture of so small an insect. The marks are of such a size that they can quite easily be photographed. In one orchard of which I am thinking they were very numerous. It was a particularly well-cared-for orchard, and the best sprayed orchard in Nova Scotia, and the insects were so numerous that the leaves looked as if they had been punctured full of holes. On looking it over, a careful examination showed that the trees were literally swarming with nymphs of the Plant Bug, millions on every tree. Simply by standing near and pointing one's finger at the branch or twig all the nymphs would come around to look at your finger, and when they had sized you up, they would suddenly drop to the ground. The farmers never suspected that there was anything like that present. There was only one man who did, and he was a very careful observer. I heard one man giving directions to a foreman not to kill the red bugs with black spots on the wings, because they ate the bugs that were doing the damage, and on no account to disturb them. He was referring to the nymphs of this Plant Bug. This insect is practically everywhere, and the farmers all complain of woody pears. On one occasion I knew of a negro who took an axe and cut down all the trees, because as he said they all grew woody fruit and were no good.

PROF. LOCHHEAD: Have you noticed that these deformed apples may appear on a single branch of a tree. I have come across some of these apples deformed to various extents. Some are only slightly deformed and others badly. Some being confined to a single branch. I could not find any bug and did not know what to do. Those who knew most about botany said that it was a case of Bitter Pit, while those who knew most about entomology said that it was some Capsid.

PROF. BRITTAIN: I have seen these deformed apples on only certain branches, but am in doubt in the case I have in mind whether this is really due to an

insect or to a form of the Bitter Pit disease. The Bitter Pit disease will occur on isolated branches of a tree with only a half dozen fruits on it while the next tree may have a whole lot of fruit on it and no disease at all. The Bitter Pit disease can be told by putting a cut through, and seeing the brown areas.

PROF. CROSBY: The more insects there are, the more a tree will be affected. This year in New York, we have more red bug injury than ever before. The increase in the injury until this year I attributed to greater attention being given to the matter, but there is a real increase in red bug injury this year.

PUBLIC MEETING.

On Thursday evening, a public meeting was held in the Lecture Hall of the University Biological Building, and was well attended, many members of the university staff and those of the various collegiate institutes and of the Royal Canadian Institute having been noticed in the audience.

The President, Dr. HEWITT, introduced the lecturer, PROF. J. H. COMSTOCK, of Cornell University, who gave a most interesting and stimulating address on "The Habits of Spiders," a subject upon which there is probably no one more competent to speak.

THE HABITS OF SPIDERS.

J. H. COMSTOCK, PROFESSOR OF ENTOMOLOGY, EMERITUS, IN CORNELL UNIVERSITY.

Professor Comstock's address was a popular account of the habits of spiders, and was illustrated by many lantern slides of extraordinary beauty made from his photographs of the various types of webs and nests of spiders and of original figures illustrating the structure of these animals. The address began with the following statement:—

"Of all our little neighbours of the fields there are none that are more universally shunned and feared than spiders, and few that deserve it less. There is a wide-spread belief that spiders are dangerous, that they are liable to bite, and that their bites are very venomous. Now this may be true of certain large species that live in hot countries; but the spiders of the Northern United States and of Canada are practically harmless."

"It is true, spiders bite and inject venom sufficient to kill a fly into the wound made by their jaws. But they are exceeding shy creatures, fearing men more than they are to be feared. If an observer will refrain from picking up a spider there is not the slightest danger of being bitten by one; and, excepting a single uncommon species, no spider is known in this part of the country whose bite would seriously affect a human being, and the venomous nature of this species is not established."

"On the other hand, spiders do much to keep in check various insect pests, and hence must be regarded as our friends. It is, however, from a different point of view that I wish to consider them at this time. It is as illustrations of remarkable development of instinctive powers, and of wonderful correlation of structure and habit. The student of nature can find no more available or more fertile field from which to make interesting subjects for study."

The more striking features of the structure of spiders were described, and especially the structure of the spinning organs and the glands that secrete the different kinds of silk, of which seven kinds have been recognized.

The various uses of silk were indicated; its use in the making of webs for capturing prey, for enveloping prey, for making egg-sacs, for making retreats, as a drag-line, and for travelling through the air.

The methods of procuring food were described: by stalking their prey, by lying in ambush, by the use of irregular webs, by the use of sheet webs, by sheet webs and irregular webs combined, by webs containing a hackled band, and by orb-webs. Photographic illustrations of all these different types of webs were shown.

A detailed account of the making of an orb-web and of the different types of orb-webs was given and illustrated by lantern slides.

Photomicrographs of the different kinds of silk were shown. Especial attention was called to the hackled band of Filistata, in which there are four kinds of silk, and to the structure of the viscid line in an ordinary orb-web.

Under the head of "The Motherhood of Spiders" an account was given of the different ways that spiders care for their eggs, and the care of their young by the members of certain families.

At the close of the address a view of a "gossamer sea" was shown. This was from a photograph of a plowed field, which was so completely covered with the silk of aeronautic spiders that it had the appearance of a lake, the furrows resembling waves.

A hearty vote of thanks, proposed by Prof. Lochhead, and seconded by Prof. Dearness, was extended to Prof. Comstock for his instructive and entertaining address.

After the lecture an informal gathering took place, at which refreshments were served by Mrs. B. A. Bensley, Mrs. E. M. Walker and Miss Snazelle, and a pleasant chat was enjoyed by the members and visitors.

SECOND DAY'S SESSION, FRIDAY, NOV. 6TH, 1914.

On Friday morning, at 9.30 o'clock, the President took the chair in the lecture room of the Royal Canadian Institute, and opened the meeting by calling upon the Secretary-Treasurer to read the Report of the Council.

REPORT OF THE COUNCIL.

The Council of the Entomological Society of Ontario begs to present its report for the year 1913-14.

The Fiftieth Annual Meeting of the Entomological Society was held at the Ontario Agricultural College, Guelph, on Wednesday, Thursday and Friday, August 27th, 28th, and 29th, 1913. The meeting of the Council and business meeting were held in the Biological Lecture-room, and the open sessions in Massey Hall. The chair was occupied by the Vice-President, Dr. C. Gordon Hewitt, Dr. Bethune being unable to act in a presidential capacity as a result of impaired eyesight.

The meetings were well attended, not only by members of the Society, visitors from the town and students and staff of the Ontario Agricultural College, but also by a considerable number of distinguished entomologists from the United States and Great Britain, present as delegates from various societies, institutions and government services.

The members and delegates were entertained during the meetings by the College authorities, being provided with accommodation in Macdonald Hall. The Council wishes to take this opportunity of expressing its appreciation of the hospitality shown by the College authorities during the course of the meeting.

The annual meeting of the Council was held on Wednesday morning. It was decided on discussion that the proposed changes in the constitution be referred to the Society, along with certain other business items. Recommendation was made to the Society that the next Annual Meeting be held in Toronto.

On Wednesday afternoon the members and delegates were formally welcomed by President Creelman of the College. Congratulatory addresses were then delivered by the various delegates and the meeting closed with a highly interesting paper by Dr. Felt, State Entomologist, of New York, on "Adaptations in Gall Midges."

On Wednesday evening Dr. and Mrs. Creelman received the delegates and members at their home, where a very enjoyable evening was spent.

Thursday morning, at 9.30, a business meeting of the Society was held. The chief business enacted was the adoption of the revised constitution of the Society. Election of one life and several corresponding members then took place. The election of officers followed, and the meeting closed with the extension of a hearty vote of thanks to Dr. and Mrs. Creelman for the numerous and varied kindnesses shown the delegates and members of the Society during the course of the meeting.

At 10.30 on Thursday, a general meeting was held. Letters and communications of a congratulatory nature were read. Dr. Bethune then delivered the presidential address on "Reminiscences of the Early Days of the Society." The remaining time of the morning and afternoon meetings was occupied with the reading of the following papers:

"Green Lanes and Byways," Rev. Dr. Fyles, Ottawa.

"On the Immature Stages of the Tenthridinidæ," Dr. A. D. MacGillivray, University of Illinois, Urbana, Ill.

"Galls," Dr. A. Cosens, Toronto.

"Chrysomelidæ of Ontario," Mr. F. J. A. Morris, Peterborough.

"Applied Entomology for the Farmer," Prof. F. M. Webster, Bureau of Entomology, Washington, D.C.

On Thursday evening a very interesting lecture, illustrated with a large number of beautiful lantern slides, on "Ants" was delivered by Dr. W. M. Wheeler, of Harvard University.

Friday, the last day of the meeting, was occupied with an excursion to Grimsby and the Niagara fruit district, and lunch was partaken of at the Village Inn, Grimsby.

The *"Canadian Entomologist,"* the monthly journal of the Society, has been issued regularly each month. The 45th volume was completed in December last. It consisted of 438 pages, and was very extensively illustrated. The circulation of the journal is now approximately 700, so the circulation has not been lowered by the increased subscription price.

In the Annual Report of the Society, besides the proceedings of the Jubilee Meeting, the reports of the various officers and branches of the Society were published, and also the following papers:

"Insects of the Season in Ontario," L. Caesar, O.A.C., Guelph.

"The Entomological Record," Arthur Gibson, Division of Entomology, Ottawa.

Regular meetings of the Society were held in the Biological Lecture-room of the Ontario Agricultural College on alternate Thursday afternoons during the winter months. In addition to the enaction of considerable business, the following papers were read and discussed:

"Entomological Notes in Egypt," by Prof. T. D. Jarvis.

"The Apple Maggot," by Mr. C. A. Good.

"Insect Pests of the Season," by Mr. L. Caesar.

"The Mole Cricket," by Dr. Bethune.

"Collecting Insects," by Mr. A. W. Baker.

"The Cherry Fruit-fly," by Mr. G. J. Spencer.

A meeting was also held in conjunction with the Wellington Field Naturalists' Club, at which Dr. W. A. Riley, of Cornell University, delivered an address on "Insects as Carriers of Disease."

The reports of the various branches showed that the year 1912-13 was a very successful one withal. The Council takes much pleasure in announcing that during 1913-14 seventy new members have joined the Society.

It is with the deepest regret that the Council records the death of two distinguished members of the Society. Mr. Henry H. Lyman, President, 1897-1899, was lost in the wreck of the steamship "Empress of Ireland" on the 29th of May last. Dr. William Saunders, C.M.G., died at his residence in London, Ontario, on the 13th of September; he was one of the original founders of the Society, for many years Editor of the *"Canadian Entomologist,"* and filled various offices, including the Presidency of the Society. Full obituary notices and portraits of both of these eminent Entomologists have already been published in the July and October issues of our magazine.

It was moved by Mr. Lochhead, and seconded by Mr. Gibson, that the Report of the Council be adopted. (Carried.)

The President: In putting this motion to the Society, I am sure that you will appreciate the fact that our Society is in a very strong and prosperous position. The increase in membership recorded is very gratifying to all members of the Society, who have felt sometimes that possibly the Society was not making the headway they would like. We certainly have no grounds for that fear at the present time. The report of the Council in regard to the *Canadian Entomologist* is most encouraging and gratifying, showing that our journal is in a very live state. I think we all appreciate the results which are following the efforts of Dr. Walker and those assisting him to make the journal a worthy Canadian journal. It is larger this year than ever before; the standard of the papers is higher, and above all, the character of the illustrations and the method of reproduction are such as have never appeared in our previous issues. Therefore, we have every reason to be proud of our journal at the present time.

REPORT OF THE MONTREAL BRANCH.

The Montreal Branch of the Entomological Society of Ontario, begs to report as follows on the work of the members for the year 1913-1914.

The 344th regular and 41st annual meeting was held on Saturday, May 9th, 1914.

The Council reported an average attendance of over six per meeting, and regretted to report the death last summer of one of our members, Mr. E. Denny. Two new members had been added to our roll and two had resigned.

The papers presented at the meetings were as follows:

1. Annual Address of President ..... G. A. Southee.
2. On the Egg of Macronoctua onusta Grote ..... A. F. Winn.
3. Captures of Lepidoptera at light for the season of 1913..... G. H. Clayson.
4. Hemiptera taken at Bondville, Que., July, 1913 ..... Geo. A. Moore.
5. Lygus pratensis Linn. A Hemipterous Insect as seen by a Lepidopterist ..... A. F. Winn.
6. Heliotropism in Butterflies, or Turning Towards the Sun.... A. F. Winn.
7. Notes on Lepidoptera Collected by Dr. E. M. Walker on a Trip to British Columbia ..... A. F. Winn.
8. Naucoridae ..... Geo. A. Moore.
9. The Breeding of Papaipema stenocelis Dyar, in one fifty mile radius of New York, by H. Bird; read by ..... H. H. Lyman.
10. Notes on the Season in England ..... L. Gibb.
11. Heredity ..... A. F. Winn.
12. Mendelism ..... Geo. A. Moore.
13. The Atlanta Meeting of the Ent. Soc. of America and the Assoc. of Economic Entomologists ..... H. H. Lyman.
14. Emesidae—Thread-legged Bugs..... Geo. A. Moore.
15. Aradidae—Flat Bugs..... Geo. A. Moore.

On January 15th, 1914, we had a microscopic exhibition at which three instruments were used and many interesting slides were shown and studied.

The Treasurer showed a balance brought forward to next year of $90.41.

The following officers were elected for the coming year:

President ..... A. F. Winn.
Vice-President ..... G. Chagnon.
Secretary ..... Geo. A. Moore.
Treasurer and Curator ..... H. H. Lyman.
Librarian ..... G. Chagnon.
Council ..... G. A. Southee, G. H. Clayson, E. C. Barwick.

Geo. A. Moore,
Secretary.

REPORT OF THE TORONTO BRANCH.

The eighteenth annual meeting of the Toronto Branch was held on Tuesday, June 9th, 1914, in the Biological Building, the President, Dr. Cosens, occupying the chair.

The minutes of the previous meeting having been read and confirmed, the report of the Council, financial report, and report of the librarian were presented and adopted.

Nine meetings, including the annual meeting, have been held during the season 1913-14. Following the precedent established last year, one special open meeting was held during the season, the attendance of visitors at which was

very good, although the number present was unfortunately reduced by the fact that the meeting was held on the same evening as the opening of the Royal Ontario Museum by H.R.H. the Duke of Connaught. At this meeting the address was given by Mr. C. W. Nash.

One meeting was also held in conjunction with the Biological Section of the Royal Canadian Institute, at which the speaker was Dr. C. G. Hewitt, Dominion Entomologist.

The average attendance at the other meetings was eight members, and in several cases visitors were present.

The interest in the papers has been broadened and perhaps increased by the fact that in one or two cases they were not strictly confined to entomology, but extended a little into other sections of biology.

The titles of the papers and addresses given during the season are as follows:

Oct. 16. Dr. A. Cosens. "Some Captures of the Season."
Dr. E. M. Walker, "A New Species of Orthoptera, Forming a New Genus and Family.
Nov. 13. Mr. E. Horne Craigie, "Summer Work in Scotland."
Dec. 11. Mr. K. F. Auden, "Arthropoda of the Bahamas."
Dr. E. M. Walker, "Primitive Insects."
Mr. Arthur Gibson (Ottawa), "The Growth and Work of the Division of Entomology."
Jan. 29. Dr. C. D. Howe (University of Toronto), "Insects in Relation to Plants."
Mar. 19. Mr. C. W. Nash, "The Place of Insects in Nature."
April 16. Dr. C. G. Hewitt, "The Control of Insect Pests in Canada."
April 23. Mr. J. B. Williams, "Some Butterflies from Java."
May 14. Dr. E. M. Walker, "Syrphidae."
June 9. Mr. S. Logier, "Ants."

A field meeting was held on May 30th, at Fisherman's Island.

Five new members have been elected by the branch during the season. The Society has suffered the loss of an old and valued member in the person of the late Dr. A. R. Abbott, and one member has resigned. The Society wishes to express its regret at the tragic death of Mr. H. H. Lyman, who, though not a member of the Toronto Branch, had upon several occasions favoured it with a paper, and was well known to many of its members.

The financial report showed a small deficit, the expenses of the Branch during the season having been considerable.

The Librarian's report showed that twenty-seven publications besides the monthly numbers of *The Entomological News* had been received during the past year.

The election of officers resulted in the re-election of all the officers and members of the Council, the vacancy made in the Council by the resignation from membership of Mr. Jackson being filled by Mr. C. A. Snazelle.

Thus the officers for the ensuing year are:

President, Dr. A. Cosens; Vice-President, Dr. E. M. Walker; Secretary-Treasurer, E. Horne Craigie; Librarian, S. Logier; Council, J. B. Williams, C. W. Nash, Arthur Smith, C. A. Snazelle.

Eight members were present at this meeting.

Respectfully submitted,

E. Horne Craigie,
Secretary.

BRITISH COLUMBIA BRANCH REPORT.

The Entomological Society of British Columbia.

January, 1914—*January,* 1915.

Publications and Meetings.

The Entomological Society of British Columbia has recently issued and distributed Bulletin No. 4 of their series (October, 1914) recounting the Proceedings of the Society at their annual meeting of January 23rd and 24th, 1914. Fifteen hundred issues of the Bulletin have been printed and a copy has been sent to every member of the Ontario Entomological Society and its various branches in the Dominion of Canada, whose name occurs in the recent "list of members."

In addition, copies have been mailed to entomologists on the mailing list in England, United States and Australia, and further, every member of the British Columbia Fruit Growers' Association will receive a copy through the medium of the Provincial Department of Agriculture.

Several hundred copies of Bulletin No. 4 still remain, and these will be sent to anyone on application to the Secretary so long as the supply lasts. The executive of the British Columbia Branch, however, reserves the right to retain as many copies of all their publications as they deem fit, now or later, for local distribution in the years to come.

All members present at the annual meeting of the Ontario Society, (November, 1914) will have received, no doubt, their copies of Bulletin No. 4 (and Bulletins 1, 2, 3) of the British Columbia Branch. It will be needless, therefore, to recount the titles of the papers presented at the various times.

The second midsummer semi-annual meeting of the British Columbia Entomological Society was held in Kelowna, in the Okanagan Valley, on August 20th, 1914, at which the following programme was presented:

"Entomological Problems Requiring Solution in Our Orchards" ..... Lionel E. Taylor, F.Z.S., M.B.O.U.
"The Practical Farm Manufacture of Combined Insecticides" ..... H. H. Creese, Asst. Fruit Pest Inspector.
"The Practical Value of Natural Methods of Insect Control Under Orchard Conditions". R. C. Treherne, Field Officer, Dom. Div. En.
"The Comparative Prevalence of Insect Pests in Various Parts of the Okanagan Valley". Max Ruhman, Asst. Prov. Ent. and Pathologist.
"Conditions Relative to the Codling Moth"... Thomas Cunningham, Prov. Insp. Fruit Pests.
"The Control of Incipient Infestation of Codling Moth" ..... W. H. Lyne, Asst. Prov. Insp. Fruit Pests.
"Aphid Notes from British Columbia" ..... Prof. H. F. Wilson, Corvallis, Oregon.
"The Occurrence of the Malarial Mosquito in the Okanagan" ..... Seymour Hadwen, D.V.Sci., Dom. Dept. Agr.
"Sprays of Up to Date Interest" ..... L. L. Palmer.
"Insect Pollination of Plants" ..... Tom Wilson, Dom. Insp. Ind. Orchards.
"Insects in Relation to Spread of Plant Diseases" ..... J. W. Eastham, Prov. Plant Pathologist.
"The Tarnished Plant Bug, Lygus pratensis". R. C. Treherne, Dom. Div. Entomology.
"Myzaphis (Aphis) abietina"..... Prof. H. F. Wilson, Corvallis, Oregon.
"General Fire Blight Discussion and Records of Insects of the Year" .....

It is hoped that the proceedings of this second midsummer meeting will appear in print as Bulletin No. 5 of the British Columbia Branch in due course, and be distributed as with the former issues.

Previous Publications.

Bulletin No. 3 recording the Proceedings of the first midsummer semi-annual meeting which took place in Vernon, in the Okanagan Valley on July 18th, 19th, 1913, was duly printed and issued to members in the fall of 1913. About 200 issues of this publication still remain in the library of the British Columbia Branch, and copies will be sent to all who require them, the Society reserving the right as before mentioned.

Bulletin No. 2, recording the Proceedings of the annual meeting of the Society which took place in Victoria, on Vancouver Island, on January 9th, 1913, has been duly printed and distributed. The issue of this bulletin is now practically exhausted.

Bulletin No. 1, recording the Proceedings of the Society at its reorganization meeting which took place in Vancouver, on December 9th, 1911, is now also nearly exhausted. Sufficient copies were printed at the time to distribute among the members of the Canadian Entomological Societies.

Bulletins Nos. 3 and 4, were printed for the Society by the "King's Printer" in Victoria, through the courtesy and authorization of the Provincial Department of Agriculture and the Department of Education. Copies of these two bulletins may be obtained free at any time by anyone, the before-mentioned reservation being enforced.

Bulletins Nos. 1 and 2 were printed at the private expense of the Society, consequently, as so few copies still remain, those requiring issues will have to make arrangements in consideration with the executive of the Society.

Five years previous to December 9th, 1911, the Society had experienced a condition of "suspended animation" and no publications were issued. Previous to that again, and following the inception proceedings of the Society in 1901, a series of pamphlets, 10 in number, were issued, but none of these now remain for distribution. It is hoped that at some time the present executive of the Society will re-issue these old records for the benefit of the present members.

Finances.

Up to and including the annual meeting of the British Columbia Branch in January, 1914, the Society has issued their publications and carried on their business from their own funds obtained by annual subscriptions and by private loans, with the exception of Bulletin No. 3, which was printed through the authorization of the Hon. Price Ellison, Minister of Agriculture for the Province. As a result the Society carried a deficit on its hands for two years amounting to about $100. During the session of the Provincial Legislature in the winter of 1914, and through the courtesy again of the Hon. the Minister of Agriculture, a grant of $350 was placed to the credit of the Entomological Society of British Columbia. In addition the printing of Bulletin No. 4 was authorized through the Government press. The grant was made available in April, 1914. The result is that at the present moment (November, 1914) past debts have been removed and the Society can be credited with having issued four bulletins of 263 pages in all, and retains a balance to its credit in the bank of over $200. With this

surplus it is proposed to arrange various illustrations of insects and insect life for the future publications, which sadly need something of the sort.

Future Prospects.

It will be a matter of interest to the members to hear that the "Entomological Society of British Columbia" went on record at its annual meeting in January, 1914, in favour of retaining their intimate connection with their parent Society, the Ontario Entomological Society.

A code of By-laws was drawn up and passed and Article 1 dealing with the "Title" states that "This Society shall be known as the 'Entomological Society of British Columbia' being the British Columbia Branch affiliated with the Entomological Society of Ontario (hereinafter called 'the parent Society')."

It will be recalled that at the inception proceedings of the Society in 1901, this Society in the West formed as a separate Entomological Society in the Dominion. A few years later it united with the Ontario Society, which at the time was the "Canadian Entomological Society," in order that the members might receive the issues of the *Canadian Entomologist*. The members of this Branch now fully realize the national character of the Society and the value and importance of co-ordinating the entomological work in the Dominion, consequently Article 2 of the By-laws states that: "This Society shall remain an integral unit in the Entomological work in the Dominion of Canada, shall remain embodied in aims and endeavours with other branches of the parent Society, and shall continue in connection with and under the constitution of the parent Society."

The remainder of the articles in the By-laws will be found on page 10, in Bulletin No. 4 of the British Columbia series, so need not be detailed here.

It has been decided that the annual meetings of the British Columbia Society shall take place in January of each year. This was considered the most suitable time of year for all concerned in British Columbia. The report of these annual meetings must, therefore, be tendered the Ontario Society, which usually holds its annual meetings in the autumn of the year, ten months after date.

It is the endeavour on the part of the Executive of the Branch to hold a popular economic midsummer meeting at some important agricultural centre in the Province every year. The object of these meetings is to bring entomological information to the farmer or fruit grower in his own locality. No business is transacted at these meetings and only advice is tendered on pests of the year and control measures. Two such meetings have already been held, one in 1913, at Vernon, and one this year at Kelowna. The attendance varied in the two meetings between 45 and 60, which sufficiently bespeaks the successful nature of such meetings.

At present the Branch exhibits plenty of "life," and the prospects are excellent for the future.

Membership.

The membership of the Society has increased during the past three years. The list of members has been published in each annual report of the Proceedings and the numbers are as follows:

Bulletin No. 1, January, 1912 ..... 24 members.
Bulletin No. 2, January, 1913 ..... 72 members.
Bulletin No. 4, January, 1914 ..... 97 members.

A few members have dropped out during this year (1914) several having left the Province to reside elsewhere. On the other hand, the executive has several more names on their records for membership at their forthcoming annual meeting in January, 1915.

Many of the members of the Branch are not active collectors or recorders, but they find a knowledge of an entomological nature useful to their business, consequently, with their application for membership before the executive, they are included as members to receive such publications as are issued.

Respectfully submitted,

R. C. Treherne,
Secretary B. C. Branch Entomological Society, Agassiz, B.C.

REPORT OF THE CURATOR.

The collections of the Society have been regularly examined and kept free from museum pests. Only a few additions of Diptera have been made during the last year. The Society is urgently in need of named specimens of Hymenoptera, Diptera and Hemiptera, and contributions from members would be greatly appreciated.

Respectfully submitted,

G. Spencer, *Curator.*

REPORT OF THE LIBRARIAN.

During the year ending October 31st, 1914, eighteen bound volumes have been added to the library, making the total number on the register 2,207. A large number of periodicals, bulletins and pamphlets are received in exchange for the *Canadian Entomologist* and as gifts from authors and publishers; these continue to remain unbound owing to the absence of local facilities for doing the work properly. During the last three months very few publications have come from the continent of Europe owing to the war, and we have discontinued mailing our magazine to the countries involved.

The library continues to be used to a large extent by the staff and students of the Biological Department of the Ontario Agricultural College, to whom it is of great value, and also to a limited extent by members of the Society at a distance.

Respectfully submitted,

Charles J. S. Bethune, *Librarian.*

REPORT OF DELEGATE TO THE ROYAL SOCIETY OF CANADA.

The President: I think the brief reference which I made yesterday in my Presidential address to the late Mr. Lyman's attendance at the Royal Society meeting can be taken as a report of the delegate to the Royal Society, if that is your wish.

ELECTION OF OFFICERS.

The meeting then proceeded with the election of officers. (See page 6.)

THE PRESIDENT: The meeting is now open to receive nominations for membership in the society.

PROF. LOCHHEAD: Besides the names of those who have already been sent in, I would beg to nominate our friend Father Leopold, of the Trappe, as a member. He has taken a great deal of interest in horticultural work—that is his speciality—but he is also a missionary or instructor of entomology amongst the French-Canadian students at Quebec. He is doing excellent work and will be one of the most valued members of our society, and the fact that he has taken the trouble to come up here on this occasion shows that he has an interest in the work. I have much pleasure in presenting Father Leopold as a member.

MR. GIBSON: I take much pleasure in seconding that motion. We have known for many years of the splendid work which Father Leopold has accomplished for the Province of Quebec, and I am sure that his identity with our society now will be a great help to all of us.

I would also like to take this opportunity of nominating Mr. J. C. Chapais as a member of the society.

THE PRESIDENT: I think the society will feel it a privilege to elect these two members. As I pointed out in my Presidential Address, they have each done most valuable work of a pioneer character in entomology in Quebec, and will certainly be an additional source of strength to the society, and, therefore, in putting their names to the meeting for election I should like you to show your appreciation of their work by a unanimous election.

THE SECRETARY then read letters from various distinguished entomologists in the United States who had been invited to the Society's meeting, but had been unable to be present.

THE PRESIDENT: Prof. Lochhead is down on the programme for a paper on "The Injurious Insects of Quebec in 1914," but I understand that he has also prepared an account of the work of Fabre, the celebrated French entomologist, whose work has come so much to the front during the last year or two. I, therefore, suggest that Prof. Lochhead give us a very brief note of the insects of Quebec, and then read to us his paper on Fabre.

BRIEF NOTES ON SOME OF THE INJURIOUS INSECTS OF QUEBEC, 1914.

W. LOCHHEAD, MACDONALD COLLEGE, QUE.

Climatic and other conditions have apparently been somewhat unfavourable to the development of injurious insects in Quebec. Dry weather prevailed during April, May and June. Over Western Quebec there occurred a period of twenty-six days—in May and June—when no rain fell. The summer of 1913 was also a dry one, and under such conditions for two successive seasons some insect forms tended to multiply. The Army-worm and the Red-Backed Cutworm (*Euxoa ochrogaster*) appeared in large numbers in some localities, the former doing damage in Pontiac County, and the latter in many sections, more especially to corn and roots.

Tent-caterpillars, which were very destructive last year, were again in evidence, but not nearly in such large numbers. Moreover, the mortality was very high, due to a bacterial disease and to dipterous and hymenopterous parasites. It is very probable, therefore, that tent-caterpillars will not be troublesome again for some years.

Farm Crops.

Aside from the Army-worm and the Red-backed Cutworm referred to, farm crops did not suffer much from insect attack. Last year, for the first time, the Clover-seed Chalcid (*Bruchophagus funebris*) was observed. This year it was again present, and a large percentage of the developing seed in the field was destroyed. A large number of larvæ and pupæ were obtained from samples of seed sown in the spring.

This insect usually winters over in the seed as a well-developed larva; the pupal stage is rather short, and the adult, which is a minute black four-winged fly about 1-12th inch long, lays her eggs in May and June. The first of the adults of this brood appear in July and August, but some do not come out until the following spring.

The Turnip Flea-beetle (*Phyllotreta vittata*) was common on crucifers in spring, and did considerable injury to seedling turnips.

Later in the season *Systena hudsonica* was found feeding on clover and potatoes, as well as on a number of wild plants.

The Pea-aphis (*Macrosiphum pisi*) was present in large numbers on peas in various parts of the province and did considerable injury.

Grasshoppers and Locusts were abundant in pasture lands, but not in sufficient numbers to cause alarm to the farmers.

Clover-root Borer (*Hylastinus obscurus*) was also abundant.

Orchard and Garden.

The Bud-worm (*Tmetocera ocellana*) is one of the most serious pests in apple orchards in Quebec. At the college the larvæ were found on apples, pear, plum and cherry. Mr. Du Porte found four different hymenopterous parasites in the pupæ. Perhaps, however, the most important parasite is *Pentarthron minutum*, which destroyed over seventy-five per cent. of the eggs.

The young apples in many orchards were injured by a species of Green Fruit-worm (*Xylina*), and many apples in August and September showed peculiar spotting of the flesh resembling Bitter Pit, which could not be accounted for satisfactorily. It is probable that some of this injury is caused by the punctures of capsids, but these were never observed at work.

Neither the Codling Worm (*Carpocapsa pomonella*) nor the Railroad Worm or Apple Maggot (*Rhagoletis pomonella*) was so abundant this year as last. In fact very few complaints reached us regarding injury from either insect. The latter insect is very common on lands in the vicinity of Macdonald College.

In some pear and cherry orchards the Pear Slug (*Eriocampoides limacina*) completely defoliated the trees in June and July, and again to some extent in September. Prompt treatment with arsenate of lead, white hellebore, freshly slaked lime, or black leaf 40, 1 pint in 100 gals. water, would have prevented injury.

The Plum Aphis (probably *Myzus mahaleb*) was abundant in the early sea-

son, but, as was to be expected, it became scarce later. It has the habit of migrating to other plants and feeding on them for the rest of the season.

Apple Aphids (mostly *Aphis pomi*), were also abundant, but it was observed that they were partially held in check by lady-birds and by Syrphidæ and lace-wing larvæ.

The Tarnished Plant-bug (*Lygus pratensis*) continues to be troublesome on a great variety of vegetable crops and flower gardens. It is the "Dahlia Bug" of the florist and the "Strawberry-button Bug" of the gardener.

Potatoes were attacked severely by the Potato Flea-beetle (*Epitrix cucumeris*) and the Colorado Potato Beetle. The Perillus was not observed feeding on the latter to any extent.

Currants and gooseberries were attacked very much as usual by the Currant Saw-fly and Currant Span-worm (*Cymatophora ribearis*), but both were readily controlled by arsenicals.

Various species of Root-maggots were present, and did much injury to onion (*Phorbia cepetorum*), to cabbage, cauliflower and radish (*Phorbia brassicaæ*), to turnips and corn (*Phorbia fusciceps*), but not to the same extent as last year.

The Beet-leaf Miner (*Pegomyia vicina*) attacked the spinach in the college plantation last year. Some varieties of mangels were badly injured.

In this Province there is much need for more information regarding the Capsidae and the Jassidae, for the impression is deepening that the bugs belonging to these two families are of much importance economically. More detailed field studies are also required of Wireworms, Cutworms and White Grubs, for very little seems to be known about their distribution.

JEAN HENRI FABRE, THE FRENCH ENTOMOLOGIST.

W. Lochhead, Macdonald College, Que.

During the past summer I came across two volumes of entomological essays by J. Henri Fabre, and read them with very great interest. His name was already known to me through his writings on Spiders and Bees, but I had no adequate conception of the wide field of insect life which Fabre has thoroughly studied during his long life. Later I picked up three other volumns of essays, likewise selections from the "Souvenirs Entomologiques," and these I found as entertaining and instructive as the first two. Ashamed of my ignorance of this master observer, I looked about for information as to his life, and I was fortunate in securing Legros' work, entitled, "Fabre, Poet of Science," published by the Century Company, which gave much of the information I desired. (See Plate, page 7.)

Jean Henri Fabre was born December 22nd, 1823, in St. Léons, in the Department of Vaucluse, near the mouths of the Rhone. His father was poor and thriftless, and moved about from place to place as a café-keeper. Young Fabre's school days, often most uninteresting, were passed at St. Léons, at Rodez, at Toulouse, and at Montpellier. At seventeen he obtained by competition a bursary into the Normal School at Avignon, where he remained two years and got his superior certificate, which permitted him to teach. His first experience along this line was gained as a primary teacher in the College of Carpentras. While there, however, he found time not only to gratify his passion to know the world of nature

about him, but also to study for specialist certificates in mathematics and physical science.

From Carpentras he went to the College in Ajaccio, in Corsica, as Professor of Physics and Chemistry, where he had an opportunity of studying nature under new and wilder conditions. He explored and collected assiduously whenever his regular duties, which were heavy, permitted. It was at Ajaccio that he came in contact with Requien and Moquin-Tandon, two celebrated naturalists, and his bent for natural history was strengthened.

From Ajaccio he went to the College at Avignon, where he remained twenty years, as Assistant-Professor of Physics. His salary was small, and his teaching duties were heavy. Notwithstanding all the difficulties he had to contend against he studied and investigated. He secured by examination his Doctorate in Sciences from Paris, and continued his researches among insects. His fine abilities as a teacher attracted the attention of Duruy, Minister of Public Instruction, who visited him and later summoned him to Paris, where he was made Chevalier of the Legion of Honour. He refused, however, to accept any offer held out to him, under the belief that independence of thought and action would be interfered with.

In 1871 Fabre left Avignon on account of the hostility of the faculty and went to live at Orange. There he wrote his celebrated scientific primers for schools, which influenced a whole generation of French youth, and which brought in some much-needed revenue. There, too, he met John Stuart Mill, who helped him out of some financial difficulties. He continued his studies of insect life, and in 1878 appeared the first volume of his "Souvenirs Entomologiques," which have made him famous throughout the entomological and literary world.

From Orange, Fabre moved to a secluded spot at Serignan—"The Hermitage" —where he lives with his family, continues his observations, and meets the many friends who come to do him homage.

At last Fabre is recognized as one of the greatest naturalists of the time. The ten volumes of "Souvenirs Entomologiques" are a monument to his genius. The tardy recognition given him by his own countrymen is due, partly at least, to his dislike for public notoriety, his aversion to the acceptance of any position which would interfere with his independence of action, and to his extreme poverty, which prevented him from leaving the little world in which he loved to labour. (See note, p. 68.)

The main purpose of this paper is to draw attention to Fabre's wonderfully delightful series of descriptive observations, studies and experiments on the habits of many common insects, a series but little known, I believe, to Canadian students of insect life. We have been so busy classifying, dissecting, and working out life-histories that we have overlooked that other interesting field of work in which Fabre has done such magnificent and lasting service.

But there is another reason why I bring Fabre to your attention. His descriptions are masterpieces. Maeterlinck, himself a student of insect life and a master of literary expression, calls Fabre the "Insects' Homer, whose brow should be girt with a double and radiant crown."

It is a pleasure to turn from the prosaic pages of most of our entomological writers to the charming descriptions of this great French writer. His pages remind us of those of Gilbert White of Selborne, and of Thoreau, whose pure literary style still charms us, and at the same time causes many of us to feel that, as a rule, we do not give sufficient attention to the literary form in which our observa-

tions are clothed. However valuable our observations may be, it is almost certain that posterity will hardly remember them as literature.

Fabre is more than a great observer and literary artist; he is also a scientific philosopher, probing into the mysteries of life and trying to find satisfactory explanations for the things he sees. He possesses, moreover, the creative imagination of a poet. He sees everywhere about him great problems of life to be solved, and his success is largely due to his marvellous knowledge of the sciences allied to his own. Everywhere throughout his essays he applies physics, chemistry, and mathematics in the discussion of his problems. The results he obtains are thoroughly original from his standpoint, since he disdains to make use of the work of other investigators. His library is scanty and he reads but little. He makes no effort to get into touch with the great minds of the day, preferring to get his information from nature herself.

It is interesting to note how Fabre looks upon evolution. His independent mind does not take kindly to theories, and his studies remind him forcibly that there are too many exceptions in nature to be pinned to any great sweeping hypothesis. He has, however, a warm affection for Darwin, with whom he corresponded because he saw in him a man searching after truth, but he could not bring himself to adopt Darwin's views of changes by slow variations. With Fabre "species are born as a whole, each at the same time and at the same moment." He sees, however, in creation continuity of progress. We wonder how he views mutations.

Legros gives us an insight into the manner of work of this remarkable man. His mornings are devoted to experiments and to writing the results of his observations; his afternoons to excursions and observations. He is unable while sitting to get his ideas into shape for writing. "Moving like a circus-horse about the great table of his laboratory, he would begin to tramp indefatigably round and round, so that his steps have worn in the tiles of the floor an ineffaceable record of the concentric track in which they moved for thirty years. His mind would grow clear and active as he walked, smoking his pipe and using his "marrow-bones," He was already at work; he was "hammering" his future chapters in his brain. He would wait until the word quivered and palpitated and lived." Then only would he sit at his little walnut table and begin to write, "his pen dipped not in ink only, but in heart's blood," first in ordinary note books, then, after compilation, "on loose sheets of paper, making one draft after another, patiently fashioning his style and polishing his work."

Another feature of Fabre's writings must not be overlooked. His language is uncommonly free from scientific technicalities and terminologies. He prefers the popular words and phrases which every person can understand. He has little use for the scientific jargon which often obscures and seldom makes clear.

After a careful reading of the volumes before me one is struck with the marvellous patience, the scientific minuteness and precision, the ingenuity, and the faculty of expressing his observations with wonderful clearness and order, shown by the author. He reveals a new world, a world so full of mystery and of tragedy that one is dazed with the new problems which are open for solution. To these difficulties Fabre says in his humility of mind: "Success is for the loud-talkers, the self-convinced dogmatists; everything is admitted on condition that it be noisily proclaimed. Let us throw off this sham and recognize that, in reality, we know nothing about anything, if things were probed to the bottom. Scientifically, nature is a riddle without a definite solution to satisfy man's curiosity. Hypothesis fol-

lows on hypothesis; the theoretical rubbish-heap accumulates; and truth ever eludes us. To know how not to know might well be the last word of wisdom."

The limited time at my disposal makes it impossible for me to show adequately how Fabre treats his themes. I venture, however, even at the risk of sacrificing the beauty, delicacy and precision of his descriptions, to make a few excerpts relating to the habits of a few forms he discusses.

First, regarding the Praying Mantis. Fabre describes minutely how it captures its prey, the mating process, and the making of its nest. I shall quote a few paragraphs of his description of its cannibalistic courtship. After mating, "the two finally separate, but they are soon to be made one flesh in a much more intimate fashion. If the poor lover is loved by his mistress as the giver of fertility, she also loves him as the choicest of game. During the day, or at latest on the morrow, he is seized by his companion, who first gnaws through the back of his neck, according to use and wont, and then methodically devours him, mouthful by mouthful leaving only the wings. Here we have no case of jealousy, but simply a depraved taste. I had the curiosity to wonder how a second male would be received by a newly fecundated female. The result of my inquiry was scandalous. The Mantis in only too many cases is never sated with embraces and conjugal feasts. After a rest, of variable duration, whether the eggs have been laid or not, a second male is welcomed and devoured like the first. A third succeeds him, does his duty, and affords yet another meal. A fourth suffers a like fate. In the course of two weeks I have seen the same Mantis treat seven husbands in this fashion. She admitted all to her embraces, and all paid for the nuptial ecstasy with their lives."

Here is his description of a massacre of Pine-caterpillars by Golden Gardeners (*Carabus auratus*): "In a spacious, glazed insectorium I have twenty-five Carabi aurati. At present they are motionless, lying beneath a piece of board which I gave them for shelter. Their bellies cooled by the sand, their backs warmed by the board, which is visited by the sun, they slumber and digest their food. By good luck I chance upon a procession of pine-caterpillars, in process of descending from their tree in search of a spot suitable for burial, the prelude to the phase of the subterranean chrysalis. Here is an excellent flock for the slaughter-house of the Carabi. I capture them and place them in the insectorium. The procession is quickly reformed; the caterpillars, to the number of perhaps a hundred and fifty, move forward in an undulating line. They pass near the piece of board, one following the other like the pigs at Chicago. The moment is propitious. I cry Havoc! and let loose the dogs of war; that is to say, I remove the plank. The sleepers immediately awake, scenting the abundant prey. One of them runs forward; three, four, follow; the whole assembly is aroused; those who are buried emerge; the whole band of cut-throats falls upon the passing flock. It is a sight never to be forgotten. The mandibles of the beetles are at work in all directions; the procession is attacked in the van, in the rear, in the centre; the victims are wounded on the back or the belly at random. The furry skins are gaping with wounds; their contents escape in knots of entrails, bright green with their aliment, the needles of the pine trees; the caterpillars writhe, struggling with loop-like movements, gripping the sand with their feet, dribbling and gnashing their mandibles. Those as yet unwounded are digging desperately in the attempt to take refuge underground. Not one succeeds. They are scarcely half-buried before some beetle runs to them and destroys them by an eviscerating wound."

Again, Fabre makes these observations regarding egg-laying in the case of the

Pea-weevil: "We should expect to find signs of a procreative economy which would impel the female to take into account the number of peas contained in the pod which she has just explored; we might expect her to set a numerical limit on her eggs in conformity with that of the peas available. But no such limit is observed. The rule of one pea to one grub is always contradicted by the multiplicity of consumers. My observations are unanimous on this point. The number of eggs deposited on one pod always exceeds the number of peas available, and often to a scandalous degree. However meagre the contents of the pod there is a superabundance of consumers. Dividing the sum of the eggs upon such or such a pod by that of the peas contained therein, I find there are five to eight claimants for each pea; I have found ten, and there is no reason why this prodigality should not go still further! What is to become of all these supernumeraries, perforce excluded from the banquet for want of space?"

Some of Fabre's most interesting observations and descriptions in the second volume before me relate to the habits of Dung Beetles, the Sacred Beetle, the Spanish Copris, Geotrupes, and others.

This is how he describes the making of the ball of manure by the Sacred Beetle, which is to serve as food later on: "Armful by armful, the material is neaped up under the belly, between the four legs, which, by a slight pressure, impart their own curve to it and give it a first fashion. Then, between whiles, the rough-hewn pill is set spinning betwixt the four branches of the two spherical compasses; it turns under the Dung Beetle's belly until it is rolled into a perfect ball. Should the surface layer lack plasticity and threaten to peel off, should some too-stringy part refuse to yield to the action of the wheel, the fore-legs correct the faulty places; their broad beeters pat the ball to give consistency to the new layer and to imbed the recalcitrant scrap into the mass.

"Under a hot sun, when the work is urgent, one stands amazed at the turner's feverish activity. And thus the business proceeds apace: what was but lately a scanty pellet is now a ball the size of a walnut; soon it will be a ball the size of an apple. I have seen greedy-guts manufacture a ball the size of one's fist. Here, of a certainty, is food in the larder for days to come!"

The ball is then rolled to its burrow, often with great difficulty, either alone or with the help of a comrade. "Let us call the two fellow-workers partners, although that is not the proper name for them, seeing that the one fastens himself upon the other, who probably accepts outside help only for fear of a worse evil. The meeting, however, is absolutely peaceful. The beetle owning the ball does not cease work for an instant at the arrival of his assistant, and the newcomer seems animated by the best intentions and sets to work on the spot. The way in which the two partners harness themselves differs. The owner occupies the chief position, the place of honour; he pushes behind the load, with his hind-legs in the air and his head down. The assistant is in the front, in the reserve position, head up, toothed arms on the ball, long hind-legs on the ground. Between the two, the ball rolls along, pushed before him by the first, dragged towards him by the second."

No one has described so well as Fabre the life and love of the dangerous Languedocian Scorpion. With his usual patient and ingenious experiments he lays bare for us the domestic life of these curious creatures. He reveals their home life, their canibalistic mating, and the production of young. Here are a few extracts relating to their mating habits:—

"There are sometimes poses of the highest originality. Front to front and

claws drawn back, two wrestlers assume the acrobat's 'straight bend,' that is to say, resting only on the fore-quarters, they raise the whole back of the body, so much so that the chest displays the four little lung-sacs uncovered. Then the tails, held vertically erect in a straight line, exchange mutual rubs, glide one over the other, while their extremities are hooked together and repeatedly fastened and unfastened. Suddenly, the friendly pyramid falls to pieces and each runs off hurriedly, without ceremony."

Again: "Two scorpions face each other, with claws outstretched and fingers clasped. It is a question of a friendly grasp of the hand and not the prelude of a battle, for the two partners behave to each other in a most peaceful way. There is one of either sex. One is paunchy and browner than the other: that is the female; the other is comparatively slim and pale: that is the male. With their tails prettily curled, the couple stroll with measured steps along the pane. The male is ahead and walks backwards, without jolt or jerk, without any resistance to overcome. The female follows obediently, clasped by her finger-tips and face to face with her leader. . . . Often they tack about. It is always the male who decides which fresh direction the pair shall take. Without releasing her hands, he turns gracefully to the left or right about and places himself side by side with his companion. Then, for a moment, with his tail laid flat, he strokes her spine. The other stands motionless, impassive."

And again: "The idyll of the evening is followed, during the night, by a hideous tragedy. Next morning, we find the scorpioness under the potsherd of the previous day. The little male is by her side, but slain and more or less devoured. He lacks the head, a claw, a pair of legs. I place the corpse in the open, on the threshold of the home. All day long the recluse does not touch it. When night returns she goes out, and, meeting the defunct on her passage, carries him off to a distance to give him a decent burial, that is to finish eating him."

Fabre has furnished characteristic descriptions of several species of flies, published in "The Life of the Fly." The following extracts are taken from his chapter on the Grey Flesh Flies:—

"Two flies of the genus Sarcophaga frequent my slaughter-yard: *Sarcophaga carnaria* and *Sarcophaga hæmorrhoidalis*, whose abdomen ends in a red speck. The first species, which is a little larger than the second, is more numerous, and does the best part of the work in the open-air shambles of the pans. It is this fly, also, who, at intervals and nearly always alone, hastens to the bait exposed on the window-sill. She comes up suddenly, timidly. Soon she calms herself and no longer thinks of fleeing when I draw near, for the dish suits her. She is surprisingly quick about her work. Twice over —— Buzz! Buzz!—the tip of her abdomen touches the meat; and the thing is done: a group of vermin wriggles out, releases itself and disperses so nimbly that I have no time to take my lens and count them accurately. As seen by the naked eye, there were a dozen of them. What has become of them? One would think they had gone into the flesh, at the very spot where they were laid, so quickly have they disappeared. But that dive into a substance of some consistency is impossible to these new-born weaklings. Where are they? I find them more or less everywhere in the creases of the meat; singly, and already groping with their mouths."

"Let us first consider the grub. It is a sturdy maggot, easy to distinguish from the Greenbottle's by its larger girth, and especially by the way in which its body terminates behind. There is here a sudden breaking-off, hollowed into a deep cup. At the bottom of this crater are two breathing-holes, two stigmata

with amber-red tips. The edge of the cavity is fringed with half a score of pointed, fleshy festoons, which diverge like the spikes of a coronet. The creature can close or open this diadem at will by bringing the denticulations together or by spreading them out wide. This protects the air-holes which might otherwise be choked up when the maggot disappears in the sea of broth. Asphyxia would supervene, if the two breathing-holes at the back became obstructed. During the immersion, the festooned coronet shuts like a flower, closing its petals and the liquid is not admitted to the cavity."

"Enclosed in her pupa, the nascent fly begins by bursting the lid of her casket with a hernia which comes beween her two eyes and doubles or trebles the size of her head. This cephalic blister throbs: it swells and subsides by turns, owing to the alternate flux and reflux of the blood. It is like the piston of an hydraulic press opening and forcing back the front part of the keg.

"The head makes its appearance. The hydrocephalous monster continues the play of her forehead, while herself remaining stationary. Inside the pupa a delicate work is being performed: the casting of the white nymphal tunic. All through this operation, the hernia is still projecting. The head is not the head of a fly, but a queer, enormous mitre, spreading at the base into two red skull-caps, which are the eyes. To split her cranium in the middle, shunt the two halves to the right and left, and send surging through the gap a tumour which staves the barrel with its pressure: this constitutes the fly's eccentric method.

"For what reason does the hernia, once the keg is staved, continue swollen and projecting? I take it to be a waste pocket into which the insect momentarily forces back its reserves of blood in order to diminish the bulk of the body to that extent and to extract it more easily from the nymphal slough and afterwards from the narrow channel of the shell. As long as the operation of the release lasts, it pushes outside all that it is able to inject of its accumulated humours; it makes itself small inside the pupa and swells into a bloated deformity without. Two hours and more are spent in this laborious stripping.

"At last the fly comes into view. The wings, mere scanty stumps, hardly reach the middle of the abdomen. On the outer edge they have a deep notch, similar to the waist of a violin. This diminishes by just so much the surface and the length, an excellent device for decreasing the friction along the earthy column which has next to be sealed. The hydrocephalous one resumes her performance more vigorously than ever; she inflates and deflates her frontal knob. The pounded sand rustles down the insect's sides. The legs play but a secondary part. Stretched behind, motionless, when the piston-stroke is delivered, they furnish a support. As the sand descends they pile it and nimbly push it back, after which they drag along lifelessly until the next avalanche. The head advances each time by a length equal to that of the sand displaced. Each stroke of the frontal swelling means a step forward. In a dry, loose soil, things go pretty fast. A column six inches high is traversed in less than a quarter of an hour.

"As soon as it reaches the surface the insect, covered with dust, proceeds to make its toilet. It thrusts out the blister of its forehead for the last time, and brushes it carefully with its front tarsi. It is important that the little pounding-engine should be carefully dusted before it is taken inside to form a forehead that will open no more: this lest any grit should lodge in the head. The wings are carefully brushed and polished; they lose their curved notches; they lengthen and spread. Then, motionless on the surface of the sand, the fly matures fully."

I could give many more passages from Fabre's delightful "Souvenirs Ento-

mologiques," all showing a master living close to Nature and with infinite patience unravelling insect secrets which have heretofore escaped less careful observers, but it is far better to read the full descriptions as he gives them. To me the perusal of these volumes revealed a great, if not the greatest, observer of the last two generations.

NOTES.

Darwin makes reference in the "Origin of Species" on three occasions to Fabre, who is termed "that inimitable observer": Chapter 4, page 108, Part I.; Chapter 8, page 336, Part I.; and Chapter 14, page 252, Part II.

A year or two ago, when it became known that Fabre was in meagre circumstances, if not in want, many noted scientific men and readers of his works were prepared to help him. He wrote: "I am poor, it is true, but I am also happy; a modest shelter, frugal food, perhaps a glass of the wine of the country or a pipe, and the delight of a Provençal garden where I can observe my beloved insects—what more could an old man who loves nature want. Thank you, but NO!"

SELECTIONS FROM "SOUVENIRS ENTOMOLOGIQUES," AVAILABLE TO ENGLISH READERS.

	Published by
"Social Life in the Insect World"	The Century Co.
"The Life and Love of the Insect"	A. & C. Black.
"The Wild Bee"	Dodd, Mead & Co.
"The Mason Bees"	Dodd, Mead & Co.
"The Life of the Fly"	McLelland & Goodchild, Toronto
"The Life of the Spider"	Dodd, Mead & Co.
"Insect Life"	Macmillan Co.

REFERENCES TO FABRE'S LIFE AND WORK.

"Fabre, Poet of Science." By Dr. C. V. Legros. Translated by Bernard Miall ..... The Century Co., New York.

"Fortnightly Review"	Vol. 98,	page	663.
" "	" 100,	"	661.
"Outlook"	" 103,	"	371.
"	" 105,	"	45.
"Literary Digest"	August 24th, 1912.		

THE PRESIDENT: I am sure that the Society is very much indebted to Prof. Lochhead for bringing to its notice—and to many of them, though I am sorry to think it, for the first time—the name of Fabre. For many years, in fact since I took an interest in entomology, which goes back to my childhood, I have always been interested in Fabre's work, and have read in the original many of his more important papers which appeared in the "Souvenirs Entomologiques." I have no hesitation saying that Fabre is, without exception, the greatest entomological observer that ever lived or perhaps ever will live. It is wonderful not only to read his inimitable language, but to read between the lines and note the extraordinary patience involved in making those observations on insect life. He would lie out on his little patch of land, and would stay there under the hottest sun for five or six hours just to watch one insect and its habits, and return day after day, sheltering under an old sunshade. Prof. Lochhead did not mention an excellent book recently written on Fabre, namely, "Fabre, the Poet of Science." I would advise everyone to read this interesting volume, in which his life is outlined and extracts given from his various books; these give a wonderful

insight into the old man's life and work. That book was only published about two years ago, because, as Prof. Lochhead has pointed out to the world in general, Fabre is really a recent discovery, but to entomologists who are interested in the habits of insects, as distinguished from their systematic relations, Fabre has long been known through his essays in the series of "Souvenirs Entomologiques" which were published in France. To those who are able and have the time I would strongly recommend them to read his essays in the original because, naturally, in the translations—while the translations are exceedingly well done—a great deal of the beauty of his French is lost. Even the translations of his descriptions in English show how magnificent and charming they are, and as Prof. Lochhead has pointed out, afford to us an excellent example to follow in descriptive work. I think our descriptions are becoming more and more less interesting—that is in entomological work, as a rule. If we can do anything that will improve our descriptive powers in entomology, we shall be doing a great service to the science in making it more interesting to others and not a "dry-as-dust" science. As I have said, and Prof. Lochhead also in regard to the recent discovery of Fabre, there are reasons for his obscurity, one of which I think was his neglect to answer his correspondence. Of course one can sympathize with him a good deal if the correspondence had been large, but there is no excuse for a man absolutely ignoring his correspondence as Fabre did. He would store away his letters and no one knew what he was doing. He did not care for the outside world; he was simply interested in his work for its own sake. There is another feature also—I am dwelling on the features which one does not like in his life as well as the more pleasing features—and that was his impatience with scientific names. Of course that is a very easy attitude to assume. It is very easy for a popular writer, but one can hardly understand it in a man of Fabre's eminence. He was truly a real entomologist, and yet time and time again he picks up a name and pokes fun at it. But he has to give names, and he has to use the name that he has given. He rather seems to put up an image only to knock it down. I do not think entomologists in foreign countries are to blame for not knowing about him in view of his great neglect of his own country. Of course it may have been due to his reclusive character. He hated publicity. He had many opportunities of becoming famous with all that it implies in friends, the receiving of distinctions, and going to Paris, but he threw it all up and kept to his little cottage where he still lives, and the way it is recorded is very delightful reading.

His writings are contributions not only to literature but positive contributions to science, and if one is working on such subjects as metamorphism, parasitism, etc., they cannot afford to neglect Fabre's observations, as I have often found in reading through many of his essays. His observations on the life history of the Meloidæ were unique in character as regards the habit of metamorphism; and then there is the extraordinary life history of parasitic insects such as the Anthrax Flies and the Odynerus Bees. In fact he anticipated much of our present work, and there is much entomological work described at the present day as original which is not original at all but anticipated by Fabre, yet was not known because his essays on those particular points had not been read. I would therefore recommend as "light reading" if you will—when one has the opportunity—the work of Fabre who, as I have said before, was certainly the greatest entomological observer and will ever remain eminent in that character. Perhaps Father Leopold would like to say a few words on this subject?

Father Leopold: I can only confirm what the President has just said. Personally I have taken very great pleasure in reading Fabre's original works.

It was in 1911, in Paris, that I was first advised to get his books. I got the ten volumes; I even got twelve—ten volumes of the whole work complete, and two other volumes of the Souvenirs, just extracts. I remember that coming back on the boat I used to take out the books and read them on the deck just as a novel or anything like that. The descriptions are so fine; it is such rich literature. You have no idea unless you get into those books what a man he is as an observer. There are so many instances of his impatience as has been said just now, that one is really astounded to see the work that has been done by him.

PROF. DEARNESS: Our President remarked just now that Fabre was the greatest of the entomological observers. I think he said that he regarded Fabre as the outstanding example. The work of the blind observer, Francois Huber, who studied so profoundly the habits and life history of the honey bee has seemed to me the most marvellous. I agree that the style in which much of the scientific literature written is not of the finest quality, but our Society can congratulate itself on having a member who adorns the expressions of his observations with as much grace as does Fabre—I refer to our honoured member, Dr. Fyles. Who can take up one of the Entomological Reports and read a paper from his pen without feeling how very graceful and interesting are the expressions of his original observations.

Prof. Lochhead's reference to the depredations on the larvæ recalls an interesting experience of my own. I had 100 or more nearly full-grown silk-worm larvæ in a suit-box kept where there was no reason to fear incursions of ants. One morning on returning to remove the frass an hour or two after the larvæ had been fed, I found an army of large brown ants—species of Lasius, I suppose—tugging at the mutilated silk-worms and struggling to carry them away. So many of them were either killed outright or so badly injured that not one in ten of them survived the attack of the ants. A single ant probably discovered the box, and then retired to summon and lead the whole ant colony to the plunder.

INSECTS INJURIOUS IN SOUTHERN QUEBEC, 1914.

C. E. PETCH, ENTOMOLOGICAL BRANCH, OTTAWA.

This year various species of caterpillars were very injurious to the foliage and fruit. Among the leaf eaters the tent-caterpillars were very serious pests again this year over the entire Province of Quebec. Some hymenopterous parasites were observed attacking the pupæ. A considerable number of egg masses have been observed and unless they are parasitized, the outlook for 1915 is serious. The lime-tree caterpillar, leaf-roller, bud moth, spring and fall canker worms were all very injurious in Huntingdon County. Late in September, the YELLOW-NECKED APPLE-TREE CATERPILLAR (*Datana ministra*) was found defoliating bass-wood trees at Howick, Que. The larvæ of the common CABBAGE BUTTERFLY (*Pontia rapæ*) were very plentiful wherever cabbages were grown. Outbreaks of the ARMY-WORM (*Leucania unipuncta*) were reported from Pontiac and Portneuf Counties.

Numerous young apples were attacked by a green caterpillar, which ate large holes in them, generally to the core. The caterpillars were a little over an inch long, naked, and light greenish-yellow with a light stripe down the middle

of the back and a much finer white stripe on either side. The apples attacked were from a few days old to ¾ in. in diameter. The damage done even in sprayed orchards was very serious. This was the most serious fruit pest this year. There were several enquiries regarding this injury, which was new to the fruit-growers in this Province. Another very serious fruit-eating caterpillar, one which has received very little prominence as such, was the BUD-MOTH larva (*Tmetocera ocellana*). These small larvæ ate irregular furrows on the surface of the fruit when nearly full grown. They fed generally under a leaf attached to the apples by some silken threads or where two apples touched. The CODLING MOTH larvæ (*Carpocapsa pomonella*) were very rarely found in the fruit this year.

The APPLE-MAGGOT (*Rhagoletis pomonella*) was very prevalent this year in some orchards of Fameuse, Twenty-Ounce, Alexander, and Wealthy. The only important scale insect was the OYSTER-SHELL SCALE (*Lepidosaphes ulmi*) but some Terrapin Scale was found on Prunus Americana and it was probably this scale which was abundant on the butternut. Large numbers of the Oyster-shell scale were found on the fruit of the apple and the plum, causing it to be greatly misshapen in many cases. Special enquiry was made about the GRAPE LEAF-HOPPER (*Typhlocyba comes*) from North Georgetown, Howick and Covey Hill. The aphids generally were quite plentiful. The PEA-APHIS (*Macrosiphum pisi*) was quite injurious near Huntingdon. The Woolly aphis was prevalent in wounds and under cankered areas. The winged form was captured in large numbers by tanglefoot bands. The green aphis was common in July on young orchard trees and nursery stock. The BUFFALO TREE-HOPPER (*Ceresa bubalus*) and some other tree-hoppers seriously injured young apple trees at Howick. Capsid bugs caused considerable injury to the fruit of apples and pears.

Flea-beetles and the Colorado potato beetle were quite common on potatoes this year. A steel-blue beetle was found injurious to turnips in Compton County. The FLAT-HEADED APPLE-TREE BORER (*Chrysobothris femorata*) was found doing considerable damage to apple trees near Abbotsford. Several species of small bark-beetles did considerable damage throughout the Province. The APPLE CURCULIO (*Anthonomus quadrigibbus*) was the second worst fruit insect this year, but the PLUM CURCULIO (*Conotrachelus nenuphar*) was of minor importance. The Buffalo CARPET BEETLE (*Anthrenus scrophulariæ*) was reported very prevalent in many homes at Tullochgorum.

GRASSHOPPERS were extremely injurious in the Three Rivers region. There may have been insects injurious locally, but those mentioned in this paper were the most important for the Province as a whole.

THE 1914 OUTBREAK OF THE ARMY WORM IN CANADA.*

ARTHUR GIBSON, CHIEF ASSISTANT ENTOMOLOGIST, DEPARTMENT OF AGRICULTURE, OTTAWA.

Farmers in many parts of Canada, particularly in the south-western portions of the Province of Ontario, will long remember the devastating hordes of the cutworm-like caterpillars of the ARMY-WORM, *Cirphus* (*Leucania*) *unipuncta*, which appeared in their fields in the latter half of July and the first part of August of the present year. The outbreak was very similar to that which occurred in Ontario in the year 1896, when 39 counties and 118 townships were infested. In the same Province, during the present year, 42 counties and districts reported Army-worms, 234 townships being infested. In many of these, however, the infestation was light, and at such points apparently little damage was done.

Fig. 9.—Army-worms in trench, Carp, Ont., July 21, 1914. This trench should have been deeper (Original).

Fortunately, too, the caterpillars appeared at a time when many fields of grain, such as oats and barley, were approaching maturity, owing largely to the dry season which forced the growth.

In Ontario, the following counties and districts were infested: Essex, Kent, Lambton, Elgin, Middlesex, Huron, Bruce, Perth, Norfolk, Oxford, Waterloo, Wellington, Grey, Dufferin, Simcoe, Peel, Halton, Wentworth, Brant, Haldimand, Welland, Lincoln, York, Ontario, Durham, Victoria, Northumberland, Peterborough, Muskoka, Parry Sound, Nipissing, Algoma, Manitoulin, Hastings, Prince Edward, Lennox, Renfrew, Lanark, Leeds, Grenville, Carleton and Temiskaming.

The Ontario outbreak of the Army-worm was investigated chiefly by Mr. H. F. Hudson, Field Officer of the Branch, who conducted a vigorous campaign in Brant and Oxford counties where much of the chief damage took place. Mr. Hudson worked jointly with Mr. A. W. Baker, of the Ontario Agricultural College, and the various Ontario District Agricultural Representatives, and for such co-operation the Entomological Branch of the Dominion Department of Agriculture is grateful.

*This is discussed in full in a bulletin on the Army-worm soon to be issued by the Entomological Branch of the Dominion Department of Agriculture.

In Quebec Province the following counties were infested: Pontiac, Wright, Richelieu, Quebec, Portneuf and Champlain.

In New Brunswick these counties were infested: Kings, Queens, Sunbury, York, St. John, and Albert.

In Nova Scotia: Yarmouth, Digby, Queens, Annapolis, Kings, Hants, Lunenburg, Halifax, Colchester, Cumberland, Pictou, Antigonish, Guysboro, Cape Breton and Inverness.

In the western provinces no injury which we could trace to the Army-worm occurred. In several instances reports of injury were received, but upon investigation the insect was found to be the Sugar Beet Webworm (*Loxostege sticticalis*).

Fig. 10.—Individual corn plant, showing complete defoliation by army-worm, Kinburn, Ont., July, 1914 (Original).

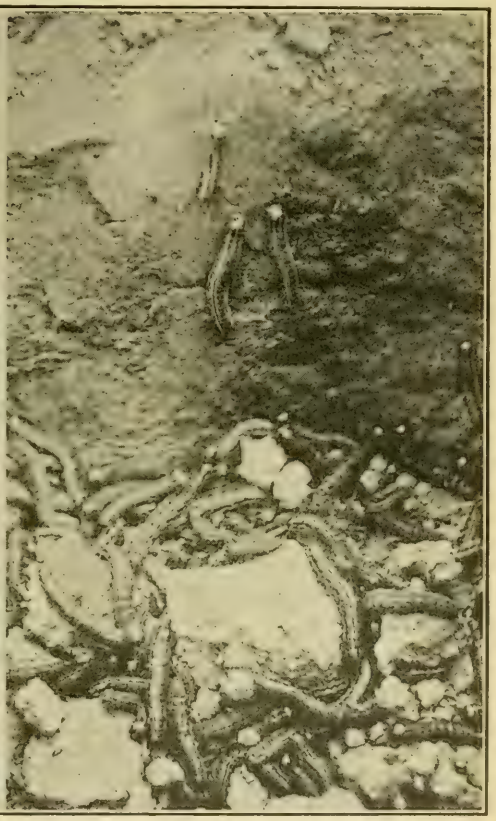

Fig. 11.—Army-worms in trench, near Kinburn, Ont., July 1914 (Original).

In Manitoba the moths of the Army-worm were present in numbers in the earlier part of August, which would indicate that caterpillars were numerous in some localities. No injury, however, was reported.

The crops attacked were oats, barley, corn, hay, spring wheat, alfalfa, clover, peas, mangolds, beets, turnips and millet. The chief damage was done to oats and to pasture lands. In Ontario in the counties of Oxford, Brant and Elgin, where the Army-worms were most abundant, whole fields of oats, corn, and barley were devastated.

It is difficult to estimate the loss caused by the Army-worm during the past summer, but undoubtedly, all things being considered, such as destruction of crops,

loss of time caused in fighting the pest, with consequent neglect of other important work at such time, cost of extra labor, Paris green, etc., and threatened shortage of food, in some instances necessitating the sale of live stock, the total loss in the Province of Ontario alone will exceed at least a quarter of a million dollars. In Quebec, Nova Scotia and New Brunswick probably fifty thousand dollars would be a conservative estimate of the loss to crops.

At the request of the Entomological Branch, the Census and Statistics Office issued a special inquiry to its crop correspondents in Ontario regarding the occurrence of the Army-worm, and this has been of great assistance in the determination of the extent of the infestation and the approximate amount of damage effected. Farmers will be interested to know that no caterpillars of the over-wintering brood of the Army-worm have been detected, even in the districts

Fig. 12.—Corn field devastated by army-worm, Kinburn, Ont., July 21, 1914 (Original).

worst infested. Special searches have been made for these without success. The injurious brood of larvæ were heavily parasitized, particularly by the Tachinid fly, *Winthemia,* and in addition a bacterial disease destroyed great numbers. Predaceous beetles were also found feeding on them.

The above brief statement will indicate the serious nature of the Army-worm outbreak of 1914. The outbreak was, I think, the most serious of any of which we have definite knowledge. The chief infestation, as above stated, occurred in Ontario, but I shall not say anything further of that outbreak here, as Mr. Baker is discussing it in his paper which treats of his investigation in that Province. A full discussion of the subject will, however, be included in a bulletin which I am preparing, and which we hope to publish shortly.

The Army-worm when full grown is about an inch and a half long. It is a brown or blackish, smooth caterpillar, with three conspicuous yellowish or pale coloured stripes above, one down the middle and the others on either side of the back. These latter are bordered above with a narrow band of black. On each side are three conspicuous wide bands, the central one being blackish and the

upper and lower ones of a yellowish colour, more or less flushed with red. There are two annual broods in Canada, the moths appearing in June and again in August and September. Those which emerge in late summer lay eggs which hatch in about ten to twelve days. The young caterpillars winter in a partially grown condition beneath tufts of grass and other low herbage, and in the spring complete their growth feeding chiefly on grasses. In June moths from these caterpillars appear and lay eggs, producing another brood of caterpillars, and this brood, which is present in July and early August, is the one which in almost every instance has injured crops in Canada.

The chief method of fighting Army-worms is to plough furrows as deeply as possible, or dig trenches in advance of the caterpillars' line of march. These trenches should be at least ten inches deep, and along in them post holes at least one foot deep—two feet are better—should be dug every fifteen feet. The side of the trench nearest the crop to be protected should be straight, trimmed, if necessary, with a spade. In this year's outbreak, in clay land, it was found advisable, before the soil became dry, to rake lightly with a garden rake the vertical side. The soil as it dried became crumbly and fell off with the Army-worms which attempted to climb up. Such raking is important, otherwise the soil becomes baked like cement and the worms will crawl up it easily. When the Army-worms reach the furrow or trench they are blocked by the straight side and at once change their course, wandering along in the trench until they reach a post hole into which they fall. When thus trapped they are easily destroyed by pouring coal oil into the hole, or by crushing them by means of the blunt end of a post. Other methods of control will be given in our Departmental publication.

The President: Mr. Baker is to give us an account of the outbreak of the Army-worm in Ontario, and for that reason I am going to defer the discussion on both these papers until after Mr. Baker's paper. Mr. Gibson pointed out, and I should like to point out also, that so far as our work in Ontario was concerned, it was largely of a co-operative nature with the Provincial Department of Agriculture, and Mr. Baker was responsible for as much of the work that Mr. Gibson has described in his paper as our officer, Mr. Hudson at the Laboratory at Strathroy, Ont. The work was carried on in the entirely co-operative manner in which we wish to have all such work carried on.

THE ARMY WORM IN ONTARIO IN 1914.

By A. W. Baker, O.A.C., Guelph.

On Tuesday, July 14th, word was received from the Provincial Deputy Minister of Agriculture that an outbreak of Army Worms was taking place in Burford Township of Brant County. On July 15th, Army Worms were found in numbers at Guelph and reports of occurrences then came in rapidly from various parts of the Province. The writer left for Burford Village immediately on the arrival of the report from that district, and found the infestation very heavy. A visit, in company with Mr. J. E. Brethour, who rendered much assistance during the outbreak in Brant County, was at once made to Mr. W. H. Milmine, Reeve of Burford Township and Warden of Brant County. A meeting of the township council was called for Wednesday afternoon. This meeting was

addressed by the writer, and the Reeve then issued a proclamation calling on the farmers of the township to aid in the fight and authorizing expenditure on the part of the township where necessary. On Wednesday, Mr. H. F. Hudson of the Dominion Entomological Branch arrived at Burford, and the remainder of the week was spent with him in a farm to farm visit of infested districts in Brant and Oxford Counties outlining control measures to the farmers and assist-

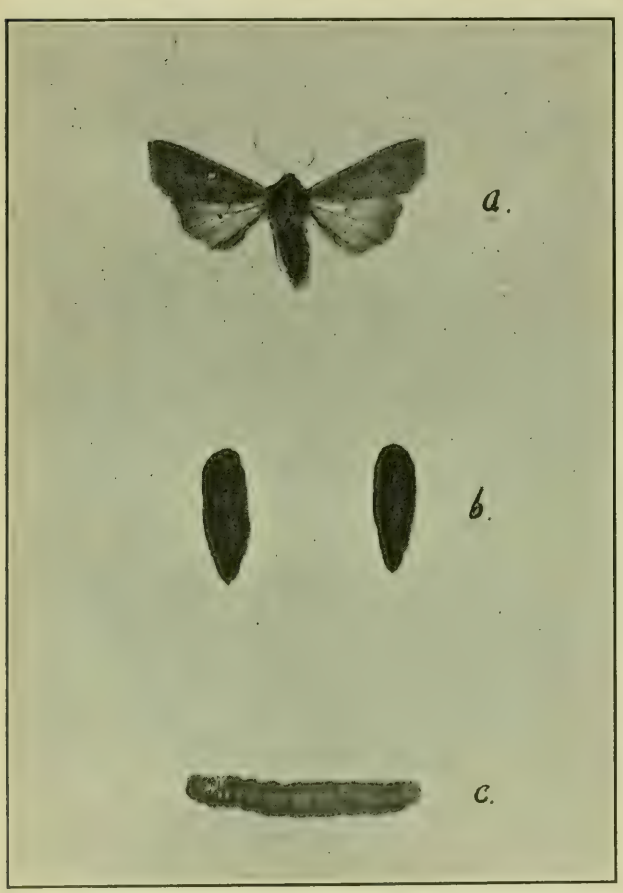

Fig. 13.—The army-worm, Heliophila (Leucania) unipuncta, Haworth.

a. Adult; *b.* Pupae; *c.* Larva, showing eggs of Red-tailed Tachina-fly.

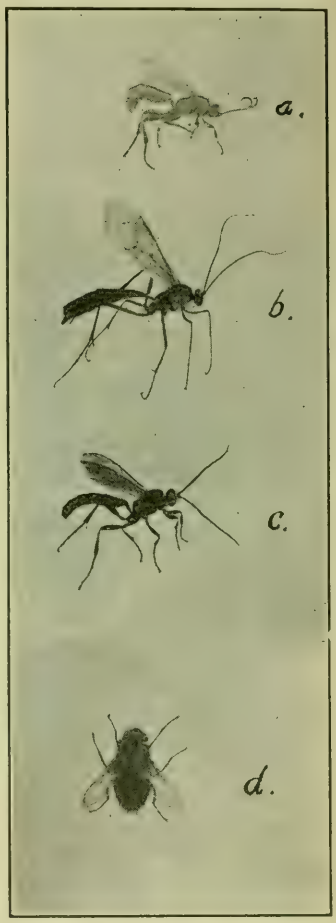

Fig. 14.—Parasites of the army-worm.
a. Ichneumon canadensis, Cress; *b.* Paniscus geminatus, Say; *c.* Ichneumon sp.; *d.* Winthemia 4-pustulata, Fabr.

ing them in the fight where necessary. Visits were then made to infested districts in various other counties by the writer and other members of the staff of the College. A press bulletin was also issued by the Department of Entomology, Ontario Agricultural College, describing the pest and outlining control measures.

The infestation in Brant County was very heavy, due to the large areas of admirable breeding grounds provided by the bottom lands of the various large

creeks running through the county. The loss in Brant was accordingly severe but the outbreak was brought under control, and the damage confined largely to restricted areas by the thorough and willing work of the farmers. In many cases men not threatened with attack came considerable distances to aid those attacked, and in instances gangs of eighteen or twenty men with half a dozen teams were busy trenching around infested areas. Where the men of a district co-operated in this way the damage was usually restricted to small areas.

Distribution Within the Province.

The Army Worm occurred practically throughout the whole Province. The following is a list of the infested counties or districts and townships. The extent of occurrence and injury has been summed up from reports by the District Representatives of the Department of Agriculture, from various private reports sent in to the Department of Entomology of the Ontario Agricultural College, and from personal observation. The writer is indebted to Mr. Arthur Gibson of the Dominion Entomological Branch for records of occurrence in townships not otherwise reported.

Essex County. General in distribution throughout the county, but serious damage only in three or four districts. Greatest injury to oats, but because of heavy crop county yield probably about normal. Reported from the following townships: Anderdon, Colchester North, Colchester South, Gosfield North, Mersea, Malden, Pelee, Rochester, Sandwich South.

Kent County. General in distribution, but serious damage confined to small areas. Reported from following townships: Camden, Chatham, Dover, Harwich, Howard, Romney, Tilbury East, Zone.

Lambton County. Extensive in distribution. Greatest injury to oats. Over half crop destroyed on forty or fifty acres, less than half on 1,000-2,000 acres. Also light infestation in various small areas. Reported from following townships: Brooke, Dawn, Enniskillen, Moore, Plympton, Sarnia.

Elgin County. General in distribution. Greatest injury to oats. Serious loss only in a few small districts. Reported from following townships: Aldborough, Bayham, Dorchester South, Dunwich, Malahide, Southwold, Yarmouth.

Middlesex County. General in distribution. Most extensive outbreak in Nissouri township and here greatest damage to pasture. Outbreaks on individual farms in other townships with chief damage to oats. Reported from following townships: Biddulph, Caradoc, Delaware, Dorchester, Ekfrid, London, Mosa, Nissouri West, Westminster.

Huron County. General in distribution. Serious damage restricted to small areas. Reported from following townships: Ashfield, Colborne, Grey, Hay, McKillop, Morris, Tuckersmith, Usborne, Wawanosh.

Bruce County. General in distribution. Damage not serious. Only two fields completely destroyed. Reported from following townships: Amabel, Albermarle, Arran, Brant, Carrick, Culross, Eastnor, Elderslie, Greenock, Huron, Saugeen.

Perth County. Extensive occurrence only on one farm; chief damage to pasture. Reported from following townships: Blanshard, Downie, Ellice.

Norfolk County. General in distribution and extensive damage especially in northern part of county. Reported from following townships: Charlotteville, Middleton, Townsend, Walsingham, Windham, Woodhouse.

Fig. 15.—Trenching ahead of the army-worm.

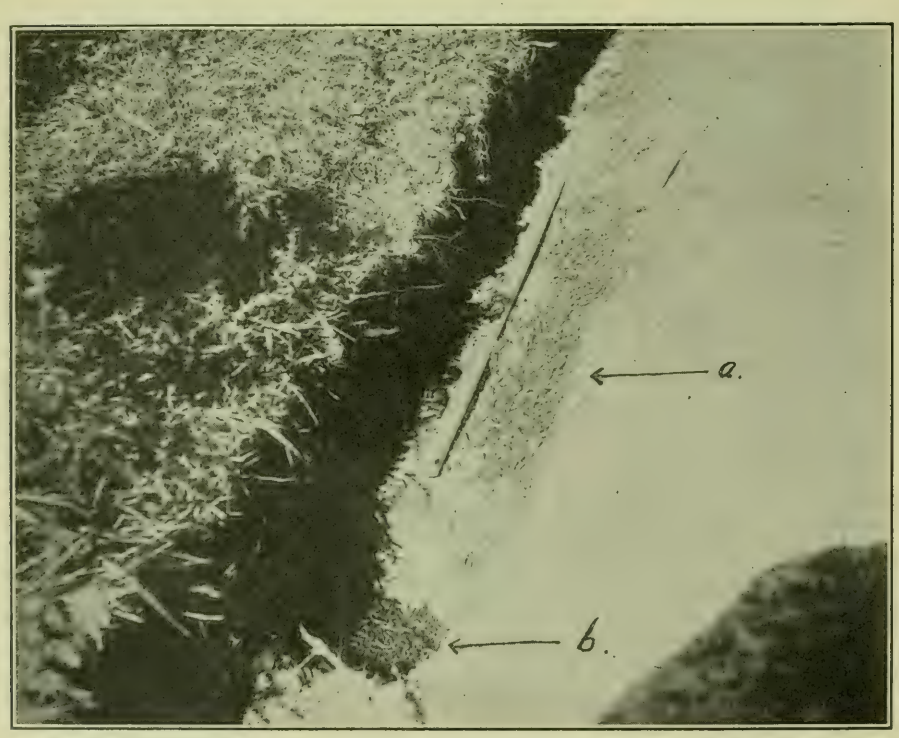

Fig. 16.—View of a trench showing army-worms in bottom (*a*), and collected in post hole (*b*).

Fig. 17.—A poorly-constructed trench. Note the loose, uneven wall up which the worms are readily passing.

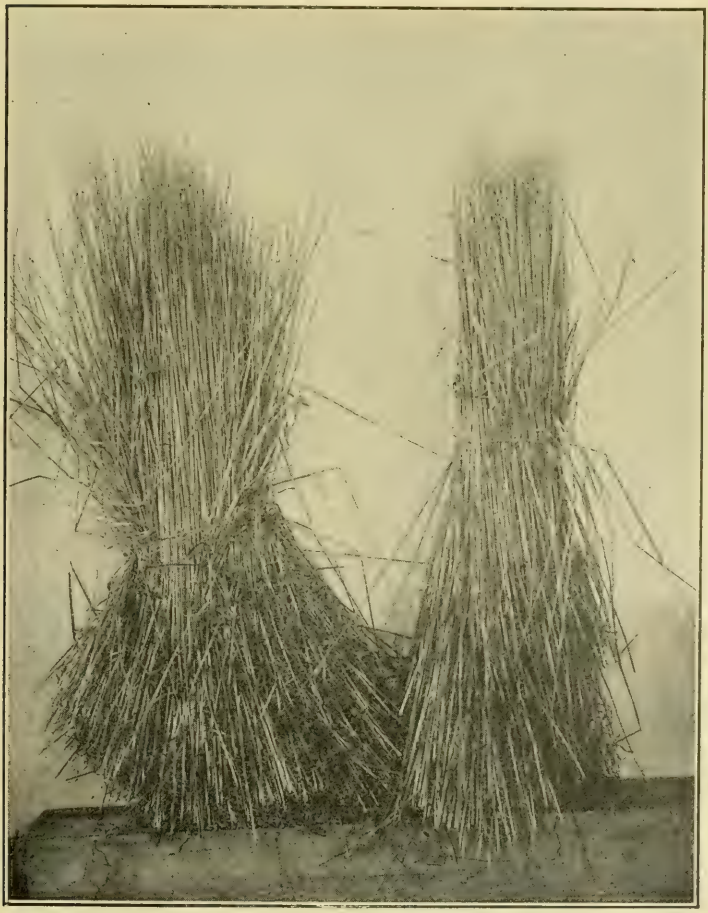

Fig. 18.—Oat sheaves, showing injury by army-worms to heads before grain was cut.

Oxford County. General in distribution. Extensive injury in four large areas and numerous small ones. Great damage, especially to pasture. Reported from following townships: Blandford, Blenheim, Dereham, Nissouri East, Norwich North, Oxford East, Oxford North, Oxford West, Zorra East, Zorra West.

Waterloo County. Serious damage only in few areas. 2,000 acres largest area. Reported from following townships: North Dumfries, Waterloo, Wilmot, Woolwich.

Wellington County. General in distribution. Injury only in small areas. Greatest damage to oats. Reported from following townships; Eramosa, Guelph, Nichol, Puslinch, West Garafraxa, West Luther.

Grey County. General in distribution, but damage comparatively slight. Reported from following townships: Derby, Egremont, Glenelg, Keppel, Proton, Sullivan, Sydenham.

Dufferin County. Limited in distribution. Areas of infestation small. Reported from following townships: Amaranth, East Garafraxa, Melancthon.

Simcoe County. General in distribution. Greatest injury to late oats and corn. Damage to other crops not over 10 per cent. in infested areas. Reported from following townships: Flos, Innisfil, Orillia, Sunnidale, Tecumseh, Tiny, Vespra.

Peel County. Most serious in Toronto Gore township. Greatest damage to oats. Reported from following townships: Chinguacousy, Toronto, Toronto Gore.

Halton County. General in distribution, but chief damage in a few limited areas. Reported from following townships: Nelson and Trafalgar.

Wentworth County. General in distribution. Damage not extensive. Most serious in pastures. Reported from following townships: Ancaster, Barton, Beverly, Binbrooke, Flamboro East, Flamboro West, Glanford, Saltfleet.

Brant County. General in distribution. Infestation over large areas. Greatest loss to pastures, but also extensive damage to timothy, oats and corn. Reported from following townships: Brantford, Burford, Dumfries South, Oakland, Onondaga, Tuscarora.

Haldimand County. General in distribution. Infested areas small. Greatest injury to green oats. Reported from following townships: Cayuga North, Dunn, Moulton, Oneida, Rainham, Seneca, Walpole.

Welland County. General in southern half of county. Serious only in a few small areas. Reported from following townships: Bertie, Humberstone, Stamford, Thorold, Wainfleet.

Lincoln County. Limited in distribution. Damage not extensive. Reported from following townships: Grantham and Niagara.

York County. General in distribution. Damage extensive over considerable areas. Reported from following townships: East Gwillimbury, King, Markham, Scarboro, Vaughan, Whitchurch.

Ontario County. General in distribution. Considerable damage to grain crops and loss in pasture extensive. Reported from following townships: Mara, Pickering, Reach, Thorah, Uxbridge, Whitby.

Durham County. Limited to a few small areas. Damage slight. Reported from following townships: Clarke, Darlington and Hope.

Victoria County. General in distribution. Present on most of farms of county but damage slight on most. Reported from following townships: Eldon, Emily, Fenelon, Laxton, Mariposa, Orps, Verulam.

Northumberland County. General in distribution. Damage not extensive.

Corn and oats attacked but chief injury to pasture. Reported from following townships: Brighton, Haldimand, Hamilton, Murray, Seymour.

Peterboro County. General in distribution. Damage not extensive over large areas. Reported from following townships: Dummer, Galway, Otonabee, Smith.

Muskoka District. Extensive in distribution. Damage considerable over large areas. Injury to timothy, oats and corn. Reported from following townships: Chaffey, Draper, Macaulay, Monck, Stisted.

Parry Sound District. Extensive in distribution. Damage over considerable areas. Reported from following townships: Armour, Hagerman, Himsworth, McMurrich, Ryerson.

Nipissing District. Chief occurrence in small isolated areas. Damage not extensive. Reported from following townships: Chisholm, Glackmeyer, Lamarche, Maisonville, Papineau, Springer.

Temiskaming District. Distribution general wherever much clearing. Damage not extensive. Reported from following townships: Armstrong, Dack, Dymond, Evanturel, Harley, Hilliard, Henwood, Hudson, Ingram, Kerns, Marter, Whitney.

Algoma District. Most extensive occurrence, over 500 acres in Bar River settlement. Also in neighbourhood of Sault Ste. Marie. Injury to timothy. Reported from following townships: Korah, Laird, Macdonald, Tarentorus.

Manitoulin District. Injury only in three localities. Chief damage on 100 acres in Carnarvon township. Reported from following townships: Assignack, Barrie Island, Carnarvon.

Hastings County. General in distribution. Chief injury to new seeding. Little done towards control. Reported from following townships: Madoc, Rawdon, Sidney, Thurlow, Tyendinaga.

Prince Edward County. General in distribution. Damage extensive, especially to pasture and corn. Reported from following townships; Ameliasburg, Athol, Hallowell, Hillier, Marysburg, Sophiasburg.

Lennox County. General in distribution. Damage extensive, especially to corn. Reported from following townships: Adolphustown, Ernesttown, Fredericksburg North, Fredericksburg South, Kaladar, Richmond.

Renfrew County. Chief occurrence in south-western part of county. Considerable damage in small areas. Greatest injury to barley. Reported from following townships: Admaston, Alice, Bromley, Horton, Ross, Westmeath.

Leeds County. No appreciable damage. Reported in small numbers in one locality of the township of Lansdowne.

Grenville County. No appreciable damage. Reported in small numbers in one locality of the township of Edwardsburg.

Lanark County. Occurrence only in two small areas. Chief damage to pasture. Reported from following townships: Pakenham and Sherbrooke South.

Carleton County. Occurrence only in northern part of county. Chief damage to oats. Reported from following townships: Fitzroy, Huntley, Torbolton.

The above records of distribution refer only to areas where Army Worms were present in sufficient numbers to do any real or appreciable damage. An examination of the appended map will show that the pest was general in distribution throughout Old Ontario with the exception of the counties in the eastern peninsula. The most northerly record was near Cochrane in Glackmeyer township of Nipissing district, and the most westerly in the neighbourhood of Sault Ste. Marie, Algoma District.

Previous Outbreaks.

In the annual report of the Entomological Society of Ontario, for 1896, Professor J. Hoyes Panton gives details of an extensive outbreak of Army Worms during that season. He also mentions that the Army Worm was reported as present in Eldon Township, Victoria County in 1833, common in many places throughout the Province in 1861, and doing considerable damage in the counties of Lambton and Victoria in July, 1894.

The 1896 outbreak was extremely extensive. An examination of Prof. Panton's map will show the distribution. As would be expected he has no records of occurrence in New Ontario. A comparison of the 1896 and 1914 outbreaks in Old Ontario shows a striking similarity of distribution. A notable exception is Brant County. There is no record of occurrence in Brant County in 1896, whereas in 1914 it was the seat of the heaviest infestation. Since Brant County contains large areas of admirable breeding grounds, this apparent non-occurrence in 1896 is difficult of explanation.

In 1896 the Army Worm was reported from 39 counties and 118 townships; in 1914 from 42 counties or districts and 234 townships.

Food Plants.

The following are the cultivated plants on which the larvæ fed during 1914, arranged in order of preference: pasture grasses, timothy, oats, corn, millet, barley, wheat and rye.

The greatest part of the feeding was on these grasses and cereals. Beets and mangels were largely free from attack; so also were potatoes, tomatoes and buckwheat. The various legumes were also practically exempt. In some cases the white clover in a pasture field was eaten to a limited extent, but not till after the grasses were entirely devoured. The writer examined numerous pea and bean fields in which the worms were present in large numbers, but in none did he see any signs of injury to the crop.

Numerous weeds and wild plants were devoured with varying degrees of avidity. No feeding on the foliage of trees was noticed, although the larvæ were observed at considerable heights on trunk and branches.

Feeding Habits.

During bright weather the worms lay inactive to a great extent during the heat of the day, taking refuge beneath sods, loose sticks, stones, etc. At about four o'clock in the afternoon they became active, and where they were present in large numbers, moved off to new feeding grounds. Feeding appeared to take place largely during the late afternoon and evening—but during dull weather the worms fed all day in numbers.

The manner of feeding varied considerably with different plants. In pastures the worms devoured all the green grass, leaving only the dead grass from the previous year, so that the ground appeared bare and brown. In timothy fields the leaves and heads were eaten, only the bare stalks remaining, so that in badly infested fields the crop was practically a complete failure. Although the leaves of oat plants were eaten to a considerable extent, much of the feeding seemed to be in the head, in the course of which the grain was cut off, so that the yield was often greatly reduced even though the infestation might not be very heavy.

On mature corn the chief feeding was in the heart of the plant where the larvæ lay concealed. Where the corn was badly attacked when still young, it was stripped to the ground. In the few fields of millet which came to the notice of the writer the entire plants were devoured, so that no vestige of the crop remained in the field. In most fields of barley the worms confined their feeding to the awns, though there was some feeding on the leaves and some injury through gnawing off the grain. Wheat and rye were both so far advanced that there was little feeding upon them, though some loss was occasioned through the larvæ gnawing off the grain from the heads.

Loss to the Province Through the 1914 Outbreak.

The loss occasioned through the feeding of the Army Worm is extremely difficult to determine. Mr. Arthur Gibson, of the Dominion Entomological Branch has estimated it at not less than a quarter of a million dollars in Ontario. In the opinion of the writer this estimate is not at all high. Estimates have been received from many of the District Representatives of the Ontario Department of Agriculture. These have all been based on injury to grain crops. A great part of the loss to the Province, however, was through the destruction of pastures and this is very difficult of estimation. Considerable loss also resulted indirectly from the loss of pastures. Men were forced to sell beef cattle at a sacrifice because of loss of pasture, and in some cases deterioration of the cattle themselves through lack of food resulted. Many dairy farmers experienced a decrease in the milk output as a result of loss of pasture, and some were even forced to sell milch cows. Considerable loss resulted from destruction of new seeding in many parts of the Province.

The loss to grain crops and timothy was, of course, very great, and if we were to add to this the direct and indirect losses through destruction of pasture and expense of time and materials used during the campaign against the pest, we would find Mr. Gibson's estimate of a quarter of a million dollars not at all excessive.

Notes on Life History.

Mr. Gibson has discussed the life history of the Army Worm in his paper, so it is not the writer's intention to say anything on the detailed life history here. A few general points, however, may be of interest. One is the length of time from the first appearance of the first brood of larvæ till its last appearance July 15th to August 15th—at Guelph, showing that egg laying must have gone on over a considerable period of time. The first brood seems on the whole to have been later than in the outbreak in 1896. Egg laying in most cases was apparently on rank grasses in low grounds, but several instances were found where egg laying had clearly been on high ground. No egg masses were found in the fall in the field and only two small imperfect egg masses were obtained in the insectary from reared specimens. No individuals of the second or fall brood were found nor were any reared in the insectary. Several reports of the occurrence of a fall brood were received, but all proved unfounded. Cannibalism was exhibited by starved larvæ in captivity as has been recorded by various writers.

Control Measures.

1. Trenches. Where the worms were moving from one area to another they were stopped by trenches placed across their line of march. Except under ideal

conditions a furrow run with a plow did not prove effective, it being found that the trench must at least be finished out by hand with a spade. After seeing trenches in various soils it was decided that a trench, to give satisfactory results, should be as follows: 15 inches to 18 inches in depth, with a clean straight side toward the direction in which the worms are going. This side may even be cut under if time will permit. The loose soil removed should be placed as a crown along this wall. In a heavy wet soil, as clay or muck, it will be found advisable to rake the surface of the straight side lightly with a garden rake before drying, otherwise the soil in baking will provide a hard continuous surface, up which the worms will readily travel. This raking should be repeated after a rain. The depth of the trench depends directly on the character of the soil and crop. In a clean sandy soil with a shallow rooted crop the trench need be only comparatively shallow. In a clay or gravel soil or one with a deep rooted crop the trench should be much deeper. At intervals of fifteen feet in the bottom of the trench post holes a foot in depth should be dug. When the worms are unable to pass up the wall of the trench they will travel lengthwise and collect in the post holes where they may be crushed with a post. During 1914, many persons attempted to kill the worms in the trenches by burning straw over them. The objection to this lies in the fact that the straws which are not burned may provide bridges out of or across the trench over which the Army Worms will pass in hundreds. Where only part of a field is attacked and the remainder is to be protected by trenching, it will be found advisable to cut a swath through the grain and rake this off before the trench is dug. This is necessary to insure a clean trench, and a clean trench is essential.

Where trenches were properly constructed excellent results were obtained, the worms being readily restricted to certain areas.

2. Poisoned Bran Mash. Where Army Worms were already present in a field and the trenches were of no value, poisoned bran mash scattered over the field gave excellent results. When tested even on areas of comparatively light infestation it gave high death counts, and in a number of districts injury to grain crops and corn was largely prevented through the timely use of the poisoned mash. The poisoned mash which gave the best results is prepared and used as follows:

Formula:

Bran	20 lbs.
Paris Green	1 lb.
Lemons or oranges	2 or 3 fruits.
Water	About 2 gals.

Mix the bran and paris green in a tub, dry, add the molasses to the water, squeeze the juice of lemons or oranges into liquid, run the rind and pulp through a meat chopper and throw this into the liquid, then pour the liquid on the poisoned bran and mix thoroughly till all is like sawdust—not sloppy.

Scatter this in the evening by hand very thinly over the infested field as if sowing grass seed. The above amount should be sufficient for at least three acres.

3. Spraying with Paris Green or Arsenate of Lead. In the past the use of a poison spray has been rather widely recommended for the Army Worm. The plan has been to spray a belt of foliage in advance of the worms. The writer had the opportunity of witnessing the results of the use of such a spray at various strengths. In some cases as much as 4 lbs. of paris green, or 6 lbs. of arsenate of lead to 100 gals. of water was used in conjunction with 4 lbs.

of soap as a sticker. At no strength and under no conditions which came to the writer's notice did the spray give even fair results. It was looked on in most places as a decided failure. The difficulty appeared to lie in the fact that where the worms were coming in large numbers they would pass through even a very wide poison belt without stopping to feed.

4. Lime, Salt or Wood-ash Barriers. Reference has been made at various times to the use of barriers of lime, common salt, wood-ashes, etc., placed across the line of march of the worms. The writer saw barriers of these various materials used in individual cases and none of them proved of any value in checking the advance of the worms, unless the barrier was so high that it proved a mechanical obstacle.

5. Land Rollers. In several instances which came under the writer's notice land rollers were used with good effect where the worms were crossing a level piece of road. The rollers, of course, were kept going constantly so that the worms were crushed as they came out of one field and before they were able to reach the other. Good results were obtained with a roller, however, only when the ground was very level.

6. Brush Drags. A correspondent has informed the writer that during the 1896 outbreak heavy brush drags were used on pasture fields with good results. Unfortunately, this information arrived too late to test on the 1914 outbreak, but the writer sees no reason why a heavy brush drag would not give good results where the worms were present in a level pasture field or roadside.

Suggestions for Control of Future Outbreaks.

From a summary of the above results one is led to conclude that any future outbreak of Army Worms can be handled successfully by:

1. The use of trenches where the worms are to be confined to a certain area.
2. The use of the poisoned bran mash where they are already scattered through a crop.
3. The use of land rollers and brush drags where conditions render practicable.

Predaceous Enemies.

Various predaceous enemies did much to control the Army Worms in some localities.

1. Domestic Animals. Pigs, chickens, turkeys, ducks, geese and pigeons were all seen to feed to engorgement on the larvæ. In one or two instances the worms were certainly kept down over small areas by the feeding of pigs and poultry.

2. Insectivorous Birds. Various species of birds fed in considerable numbers on the larvæ.

3. Predaceous Insects. Various species of large ground beetles, such as *Calosoma calidum*, Fab., *C. scrutator*, Fab., and *Harpalus caliginosus*, Fab., as well as many smaller species were observed feeding on the larvæ in large numbers.

Parasites.

The larvæ were heavily parasitized by insects during 1914, and this extensive occurrence of parasites had doubtless much to do with the rapid reduction in numbers of the first brood.

The material from which the parasites given below were reared was all collected at Guelph. Accordingly the distribution throughout the Province of most of the species is unknown to the writer. The "Red-tailed Tachina-fly," *Winthemia 4-pustulata,* Fab., and *Apanteles militaris,* Walsh, were general in distribution and numerous in all the counties visited.

The following are the species of parasites reared from the Army Worm at Guelph during 1914.

Tachinidæ.

1. *Phorocera* (*Euphorocera*) *claripennis,* Macq. Reared one specimen at Guelph.

2. *Wagneria* (*Phorichæta*) *sequax,* Will. Reared one specimen at Guelph.

3. *Winthemia 4-pustulata,* Fab. Reared in large numbers at Guelph, and generally distributed throughout the Province, farmers in all parts being familiar with the white eggs deposited on the thorax of the caterpillar immediately behind the head. The adults were first observed egg-laying on July 16th in Burford Township of Brant County, and on July 17th at Guelph. Early in the season only one or two eggs were laid on a single Army Worm, but as the season advanced and the Tachina-flies increased in number, the number of eggs per larva also increased. The largest number of eggs found on one larva was 38. It was noted that late in the season when the number of eggs per larva was large the percentage of eggs hatching was smaller than earlier in the season when the number of eggs per larva was smaller. *Winthemia* larvæ were observed to pupate within the body of the host as well as without, but those which came out to pupate emerged earlier than those which remained within the body of the host. Parasitized Army Worms which were killed by poisoned bran mash on July 22nd still contained living Tachinid larvæ on July 24th. One of these Army Worms was opened on this date and five Tachinid larvæ were found. Four of these were retained for examination, but one was placed back in the body of the dead Army Worm. This larva lived. It pupated on July 26th and the adult emerged on August 8th.

Individuals of this species were reared through as follows:

Eggs laid	Aug. 8th	Incubation period 4 days.
Eggs hatched	Aug. 12th	
Larvæ pupated	Aug. 16th	Larval period 4 days.
Adults emerged	Aug. 29th	Pupal period 13 days.

In this case out of six eggs laid on the Army Worm four adults were obtained.

Ichneumonidæ.

1. *Ichneumon canadensis,* Cress. Reared in considerable numbers and observed commonly during 1914 outbreak in the fields at Guelph.

2. *Ichneumon jucundus,* Brulle. Reared in considerable numbers and observed commonly at Guelph.

3. *Ichneumon,* sp. This is a yellow banded form which has not yet been satisfactorily identified to species. It was the most common Ichneumon parasite at Guelph, being present in the infested fields in large numbers.

4. *Paniscus geminatus,* Say. Reared in numbers and numerous specimens captured on the wing.

5. *Mesochorus vitreus,* Walsh. Reared in numbers at Guelph. Walsh originally described this as a primary parasite of the Army Worm but Riley later stated that it was a parasite on Microgasters. In this case it was probably parasitic on Apanteles.

Braconidæ.

1. *Apanteles militaris,* Walsh. Present in large numbers at Guelph and apparently general throughout the Province. The cocoons of this species are placed in a loose white mass. These cocoon-masses were found in almost every infested area and were often mistaken by farmers for the eggs of the Army Worm. As many as 28 Braconid larvæ were dissected from one Army Worm.

2. *Apanteles,* sp. This species, which has not yet been identified, differs from *A. militaris* in that it has an elongate compact sulphury cocoon-mass. It was frequent at Guelph and in various other parts of the Province.

3. *Meteorus communis,* Cress. One specimen reared at Guelph.

Chalcididæ.

Eupteromalus sp. Reared in large numbers at Guelph from Army Worm larvæ and pupæ. As many as 74 Chalcid pupæ were dissected from one Army Worm pupa.

In addition to the above insect parasites the Army Worms were attacked by a bacterial disease.

The identification of Tachinidæ parasitic on the Army Worm were made for the writer by Mr. J. D. Tothill, of the Entomological Branch of the Dominion Department of Agriculture. The Hymenopterous parasites listed were determined by Mr. A. B. Gahan, of the Bureau of Entomology, U. S. Department of Agriculture.

The writer is indebted to Mr. J. P. Henderson, of Toronto, for numerous photographs of the outbreak in Brant County, some of which are reproduced.

The laboratory and insectary work in connection with the study of the Army Worm and parasites was carried on by Messrs. A. R. Burrows and R. S. Hartley, student-assistants of the Department of Entomology, Ontario Agricultural College.

Prof. Dearness: I saw the worms in Brant County in 1896.

Mr. Baker: Brant County has a number of large creeks running throughout the county, and large areas of flat lands stretching on each side of these which provide excellent breeding grounds. In many cases the roads would be black with them passing up from the flat areas to the crops. I can hardly credit the report of Prof. Panton that in 1896 when there was a severe outbreak, Brant and Oxford Counties should be free.

Prof. Caesar: For fear that it should be overlooked, I want to refer to a letter sent me by Prof. Dean of Kansas in connection with the army worm. I have had some correspondence with him on two or three things, and he made some reference to the army worm in that correspondence. He said he had found the new remedy for the grasshoppers so effective in preliminary tests that he recommended to the various counties in his section of Kansas that they set apart a day for army worm control and that they call it "army worm day" just as they had done in previous years for the grasshoppers. Their outbreak was in the spring of the year. As a result of this remedy—the sweetened poison bran—he said that one day's treatment resulted in complete control of the army worm all over the counties that used the remedy. I think that is very valuable. No doubt he will publish a paper on that subject, and we shall have fuller details sometime early in the spring.

The Secretary: Could you let us know how much they used there.

Prof. Caesar: I cannot give you the details of it. I intended to write to him for I was especially interested in the control of the army worm in corn fields. Those

of you who have observed the work of the army worm in such fields find that in the day time the worms are in the sheath concealed by the foliage, and the question arises, can a poison bran destroy the pest in the corn under those conditions. Personally I did very little work with the army worm. I made the test of the poisoned bran incidentally, and had to go away at once. The report when I came back was very favourable, we were not able to see it tested out in the grain fields. There were 270 killed to one yard in our test. That was where it was thrown over a field just like you would for the grasshoppers—five pounds to about 4 acres.

THE PRESIDENT: We are very pleased to have with us Mr. Vernon King, who is a former student of the Agricultural College, and is now on his way to England to take part in the defense of the Empire, in which he will have our very sincere wishes for his safe return and success, and we should like to hear from him his experience in Missouri, where I believe they had some work carried on with the army worm under Mr. Webster of the United States Bureau of Entomology, Washington.

MR. KING: Thank you for your kind wishes for my welfare. As regards my work in Missouri, things are a little different. There are different conditions as regards entomological work than there are here. We have not the diversity of crops which you have here, and we do not meet with the difficulties in controlling the army worm down there. In two years—the last two years, 1913 and this spring—the army worms were very numerous in our locality, and always appeared in the wheat earlier, and were always preceded by large numbers of Bobolink and Red-winged Black birds, so that the farmers even now believe that they are responsible for the army worm. They do not distinguish between the two birds. They just give them a casual glance. The strange thing is that both times I have been there, the birds did precede the army worm, and when the latter were most numerous the birds went, so they asked me for an explanation. They would say that the birds had the germs in their wings and fluttered them out over the wheat. I tried to explain that that was not the case, and they wanted to know how I knew. I tried to explain that, too. I cannot account for the fact that they come when the food is plentiful unless the birds happen to be migrating at that time and going north, and possibly they may feed on the army worm.

As to the control of the army worm, I have had an opportunity of seeing large numbers of instances of ditching. As Mr. Baker said, it depends upon the soil and the way they do it. The best way I have seen is to plough a furrow and drag along by a chain a log about 8 inches in diameter; a darkey would sit on this with two sticks to balance himself. I have tried that, and it takes a little practise, especially in turning corners. That is the first process with a little log of small diameter which gets right to the bottom of the furrow. Next they use a little larger log of about 14 inches diameter. That of course gets some at the bottom and some at the side, and they finish off with a barrel, the darkey still sitting on it with his legs crossed and resting on the whipple-tree. That is in the morning about 8 o'clock. The worms come out about 2. The barrel makes the sides smooth. The worms continue for about ten days. I have seen some men in the hard land dig post holes, but that has no effect whatever for the holes soon fill up with clods. The best success was with the dragging.

The farmers claimed that the worms were beneficial in the wheat because they ate the leaves off.

In the post holes the Calosoma Beetles gathered in large numbers, and so while I was collecting some army worm parasites (there are lots there,

and snakes and toads and everything else) it occurred to me that the beetles might be useful. I wired Prof. Webster and he told me to send them to New Mexico. The chief harm done by the army worm was the time lost by the farmers. I managed to send hundreds and thousands of black beetles to New Mexico for the control of the Range Caterpillar. Later when the army worm had gone, the beetles came to the light and were found under the wheat sheaves. I believe that if it was not for the army worm there would have been no beetles. So far as the control is concerned, I found that the ditching was the only way. I did try poison, but there were too many of them, and they would go over it and get into the ditch and the corn.

PROF. DEARNESS: Regarding the sudden appearance of the army worm is there any explanation?

MR. GIBSON: It is not thoroughly understood how such insects increase in numbers so suddenly, but I believe, of course, that it is largely a question of parasites and weather conditions. As far as we know the army worm hibernates as a partly-grown caterpillar. We have been trying to find out definitely in what stage the caterpillar does pass the winter, but we have not been able to hear of any locality where specimens of the overwintering brood were located. One correspondent reported that he found four caterpillars of the fall brood on corn. These, however, were specimens of the corn ear worms. I should like to know if Mr. Baker has received any reports regarding this brood.

MR. BAKER: We received reports of the second brood, but found none on examination. All reports proved to be false. We have no definite record of any second brood this year. Any records we received proved on examination to be something else.

MR. GIBSON: In Nova Scotia Mr. Saunders spent several days searching for eggs and young larvae, but was unable to find any specimens whatever. Mr. Hudson also made search in Western Ontario, and investigations were also undertaken near Ottawa where the worms appeared, without results.

MR. BAKER: We have failed at Guelph also in securing the egg stage. We got one small cluster of eggs in the field, but no appearance of eggs in our rearing cages.

PROF. DEARNESS: Mr. Gibson mentioned that a large number of the moths had been taken on Sable Island. I suppose they were carried there by the wind.

MR. GIBSON: We intend to look up the records in this respect to find the direction of the wind during the days the moths were attracted to the lighthouses, but we have not yet been able to do so. Sable Island is 140 miles east of Nova Scotia.

THE PRESIDENT: That observation regarding the occurrence of the army worm moths at Sable Island was more or less incidental or accidental. The primary reason for getting it was that we wrote to the Superintendent at Sable Island, which is under the Department of Marine Fisheries, in connection with our work on the Brown-tail Moth in order to get records of flight. We hoped to be able to get details as to seasonal flight, etc. of those moths attracted there by the Sable Island lights. We did not receive any Brown-tail Moths, but we got adults of the army worm which we happened to be working on at the same time.

MR. KING: At what date do the birds migrate? Would it be about the middle of May?

THE PRESIDENT: I think Mr. Criddle would be better able to give you data regarding the migration of these two species of bird, or Mr. Calvert, but Mr. Criddle is in Manitoba which is more on the direct line of migration. There should be no migration during the time you speak of. There may possibly be, but the reason

would be that the red wing blackbirds and the Bobolink would find the presence of enormous quantities of these larvæ too much of a good thing, and would get out.

MR. CRIDDLE: My observation of the Bobolink is that the migration would be during the middle of May. The Red-wing Blackbird is a very early bird and arrives in Manitoba about the first week in April. It retires to the marshes to breed about the end of that month and this might account for their leaving the fields infested by army worms.

MR. SWAINE: Have you observed that they feed upon the caterpillars in the South to a great extent? I thought the Bobolink in particular was a grain feeding bird while in the Southern States.

MR. CRIDDLE: So far as I know, the Bobolink is certainly a rice feeding bird, particularly in the autumn, but in the north it is almost entirely an insect feeder. There are two distinct features in the bird's life. In the one case it is injurious but in the other beneficial. I think the United States Department in their laws have protected the birds at all times of the year, except in the rice growing region.

PROF. LOCHHEAD: Can these men who have been in the field prophesy as to next season?

MR. BAKER: Everyone who has been in the field working on the army worm has been prophesying since the middle of June, and I think that—working on the basis of the fact that there is no appreciable second brood, and in view of the fact that it would be unique in the history of the army worm with us that there should be any second occurrence, I think we can say that there will be no outbreak next year. I have not been able to get any records of a second outbreak under such conditions as we have here.

MR. KING: There is a recurrence in Missouri and those States, frequently. In fact the army worm is present every year. That I think is not in the same class as our outbreak here, and also there is the fact that we had no second brood.

MR. GIBSON: The second brood would be very difficult to find and I do not think that this brood which occurs in autumn and over winter would ever be found to be injurious.

MR. BAKER: Not injurious, but present.

DR. BETHUNE: Would they not become extinct if there were no second brood?

PROF. LOCHHEAD: The conditions depend upon climatic factors and parasites. Climatic factors are very important. Two seasons would do it. All dry seasons—for instance, this season as far as Eastern Ontario was concerned—we had nearly a month or 26 days without rain during parts of May and June in Montreal—that held up as far as Ottawa, and last season was also a very dry one. These two factors seem to stand out as important in all cutworm attacks. The dry weather favours the development of cutworms.

MR. BAKER: In Brant County where the worst infestation occurred all the areas that were attacked, practically without exception, were flooded deeply in June. There were heavy rains early in that month and all the areas where the army worm fed were deeply flooded for a period I believe of two or three days.

MOUNTAINS AND HILLS.

Rev. Dr. Thomas W. Fyles, Ottawa.

In that stretch of country which lies between Lake Memphremagog and the River St. Lawrence, the natural elevations are striking features of the scenery, and add much to its beauty. A continuation or spur of the Vermont passes through the Townships of Sutton, Brome, Potton, and Bolton; and in the lower country rise solitary peaks of remarkable formation—Shefford Mountain, Yamaska, Rougemont, The Pinnacle, Beloeil, Montarville, Mount Royal, and others. At the foot of Mount Royal, and rapidly extending around it, lies the City of Montreal. In this city, in the year 1861, I took up my abode.

Montreal, at that time, was a comparatively small and quiet place. A few particulars will help you to realize the change that has taken place in it.

Where St. George's Church, and the Canadian Pacific Railway Station now stand, there was then an orchard of *Pomme gré* and *Fameuse* apples, skirted by a lane which bore the name of St. Janvier Street. To the east of this was a large cemetery. Between Dorchester Street and Sherbrooke Street were vacant fields. The City of Westmount was then undreamt of.

The Grand Trunk Railway ran from a small and shabby station, on Bonaventure Street, to the main line at Lachine. Travellers for the east had to find their way to Point St. Charles as best they could.

In 1862 I began to form the collection of Lepidoptera which is now in the Provincial Museum at Quebec. My hunting-ground was the Mountain, and a productive one I found it. To reach it, I walked along the Côte-des-Neiges road, as far as the grounds of Judge McCord, who had a house built in form of a Grecian temple, with portico and columns. I had permission to pass through the premises at any time. Beyond the garden fence the mountain rose, steep, and rough, and thicketty.

One day, in the height of summer, I crossed the mountain brow, and a charming ing scene lay before me. There were a sugar bush, cultivated land, and a peaceful dwelling. The sun was bright; the air was still; and—

"The insect world was on the wing." I was well acquainted with the British Rhopalocera, and had a warm apprecation of its beauties, but here a new insect fauna was represented.

Dancing over the meadow-land, were scores of butterflies of the species *Argynnis cybele* Fabr.; and amongst them—smaller and less stately, but closely resembling them—were numbers of *Argynnis aphrodite* Fabr. Around the second growth trees at the borders of the clearing, *Papilio turnus* Linn. and *Limenitis arthemis* Drury sported gaily. I watched them with great delight.

But in this nook on the mountain top there were not only fine insects; there were beautiful birds. To mention a few there were:

The Blackburnian Warbler, *Dendroica blackburniæ* Baird.

The Yellow Warbler, *Dendroica aestiva* Baird.

The Red-eyed Vireo, *Vireosylva olivacea* Linn.

The Cedar Waxwing, *Ampelis cedrorum* Gray.

The Purple Finch, *Carpodacus purpureus* Gray.

Having come from the Old Country, where white butterflies abound, I wondered at the paucity of such in the scene before me. One or two specimens of *Pontia oleracea* Harris only, were to be seen. In Harris's "Insects Injurious to Vegetation" (Flint's edition published in 1862) this insect is well figured and its life history is given. Dr. Bethune also gave a good account of it in 1871, in the 2nd Report of our

Society. Since those days it has been strangely mixed up with the English *Pontia napi* Linn. It is now said to be one of several forms of this species. By a "form" I suppose is meant a variety that reproduces itself. I think we may fairly ask, Does the form ever return to the type? Has anyone ever raised *napi* from eggs of *oleracea,* or *vice versa,* has anyone ever raised *oleracea* from eggs of *napi?*

The mountain did not always present to me the charm of a smiling countenance. My duties as a Deacon in old St. George's under Archdeacon Leach and the Rev. W. B. Bond, often took me to Côte-des-Neiges; and friends there showed me a short cut over the mountain, which brought me out near the Reservoir not far from the head of Drummond Street.

On one occasion I was detained till nightfall, and a thunder storm overtook me on my way home. My walk was a dreary one, but I amused myself by stringing together these lines:

The Ethiop, Night, her darkest shadow flings;
  With densest cumuli the sky is spread;
And solemn Silence, on her owlet wings,
  Glides fitfully around the mountain's head.
The city's many lights below are scatter'd,
  And, here and there, a fire-fly's lamp is seen,—
Ah, now the tempest comes! The clouds are shatter'd,
  And from the Thunderer's hand the lightnings gleam.
Birches and pines above my pathway quiver;
  And, for a moment, blue, unearthly bright,
The city and the mountains and the river
  (Oh, wondrous fairy vision!) burst in sight.
A moment more, and deafening is the din,
As if high heaven's huge dome were tumbling in.

How wonderful is the illuminating power of the lightning! Not only the immediate surroundings were momentarily brought into view by it, the far-away mountains were also shewn. I wondered what sort of folk lived among those distant hills. I little thought that twenty years of my life would be spent among them. During those twenty years I gathered, and since that time I have been gathering scraps of information in Natural History, and with your permission I will say a few words respecting (1) some of the mammals; (2) some of the birds, and (3) some of the insects I have learned of.

Mammals.

A few months ago my son Mr. Francis F. Fyles of Riverdale, Abercorn, Sutton Township, took me for an automobile ride up the Pinnacle, as far as the last farm on the shoulder of the mountain. On our way we passed two Skunk Preserves, or "farms" belonging respectively to Mr. Byron Spencer and Mr. Ernest Johnson. A short account of Mr. Johnson's farm appeared in *Rod and Gun* for May last, with an illustration showing the owner and four friends holding up live skunks each by the tail, but very little information is given respecting the animals.

The skunk-yard is enclosed with sheet-metal sunk to a considerable depth, and bent inward at the top, that the animals may not escape, either by burrowing or climbing. Snug dens are provided for the comfort of the animals, and divisions are made in the yard for their separation when necessary.

A few skunks captured by the aid of a dog, were placed in the pens. They rapidly increased in number, for the females bring forth from three to nine young at a litter. These are pretty little creatures as frolicsome as kittens. They are in their

prime in a year. To kill them the owner catches them up suddenly by the tail and strikes them a smart blow on the head with a stick. When lifted from the ground by the tail, they are unable to eject their offensive fluid.

Of the pelts there are four grades:

No. 1. All black, valued at from $3.00 to $4.00.

No. 2. Having a short white stripe, valued at $1.75.

No. 3. Having a long narrow white stripe, valued at $1.00.

No. 4. Having a long broad white stripe, valued at $0.50.

These values are per skin (prime).

The skunks are not costly stock. They are fed upon corn-bread, johnny cake, potatoes, green corn, scraps of meat, etc.

Strange to say the fetor of the skunk is not repulsive to every one. An English gentleman came to see me when I lived at South Quebec. He was interested in Natural History. In the course of the evening I went to my front door. A skunk had passed over the lawn in front of it, and left a strong taint. I called to my visitor, "Sir, there is something here you should know of." He came, and sniff! sniff! "What is that? What is that? Do you know I rather like that." Well, every one to his taste.

In a state of nature the female skunk chooses for her abode a deserted Woodchuck's burrow lining the chamber with leaves and grass. There she brings forth and suckles her young, blanketing them with her ample tail. Notwithstanding her ill savour, she should be ranked among the farmer's friends, for she lives—as does her mate—on grasshoppers, crickets, June beetles, white grubs, cutworms, and other pests. Of course she should be kept from the poultry houses.

The skunk is not at all a shy animal, it seems to be conscious of its powers. One day I was walking by a wood-side, when I saw a skunk, and it saw me. It came trotting towards me, but I respectfully declined a closer interview, and hurried away as fast as I could with dignity.

The Woodchuck (*Arctomys monax*) is an animal familiar on our hillsides. It is a vegetarian, and does mischief in our fields and gardens. I shot one of these creatures that had a burrow on my land in Brome, intending to make a drawing of it, but, when I came to take it up, I found that it was covered with ticks. The number of these was incredible. When their host died, they let go their hold on its flesh, and came to the outside of its fur.

Once on a time I witnessed a battle royal. Behind the Missisquoi High School at Cowansville (which belonged to the English Church) I had a large garden. At the back of the school stable, a load or two of stones were piled. On a certain occasion I went to my garden followed by my little dog, Pepper, a Skye Terrier. A woodchuck ran from among the vegetables and disappeared in a burrow it had made under the pile of stones. Pepper was at his heels and followed him into his den. I was aware of a desperate underground struggle. The woodchuck whinnied like a horse. It was heavier than its opponent, but the dog prevailed. It not only killed the woodchuck, it dragged it out of its den. But so exhausting had been the struggle that the little victor threw himself on its side, stretched out its limbs, and lay as if dead. I began to think it was dead. But in ten minutes it arose and shook itself, and after receiving my commendations, followed me complaisantly home.

Since the game laws have been more strictly enforced the red deer (*Odocoileus americanus*) has often been seen on our hillsides.

My son has a wood-lot and pasture about a mile from his home in the valley. On several visits to these he saw two deer companionably grazing with his young stock.

The Fox (*Vulpes pennsylvanicus*) is still common in the hill country. Travelling in the train on one occasion I saw, through the car window, a fox hunting for mice and ground birds in the meadows below. The animal paused, lifted up its head, and with the utmost nonchalance watched the train go by.

Among other wild animals that frequently, or occasionally visit our mountainous districts, are the Bear (*Ursus americanus*), the Lynx (*Lynx canadensis*), the Raccoon (*Procyon lotor*), the Porcupine (*Erethizon dorsatus*), the Hare (*Lepus americanus*).

A hunter told of seeing tracks of a Sable (*Mustela americana*) on Round Top, the highest of the Sutton peaks.

Birds.

Of birds that are seen on our hills many are summer visitors. These mostly arrive about the 10th or 15th of May. I saw, season after season, in the maple woods near the frontier that handsome bird the Scarlet Tanager (*Piranga erythromela,* Vieill), and his modestly attired mate. The notes of the male somewhat resemble those of the robin.

The Rose-breasted Grosbeak (*Habia ludoviciana,* Linn.) was another fine bird that now and then adorned the fields and woods.

Welcome to every one was the dear little Bluebird (*Sialia sialis sialis,* Linn.) which came to cheer us with its sweet notes, and to render its services to the husbandman and fruit grower.

Wilson thus sings in its praise:

> "He flits through the orchard, he visits each tree,
> The red-flowering peach, and the apple's sweet blossoms;
> He snaps up destroyers wherever they be,
> And seizes the caitiffs that lurk in their bosoms;
> He drags the vile grub from the corn it devours,
> The worms from the webs where they riot and welter;
> His songs and his services freely are ours,
> And all that he asks is in summer a shelter."

One day, approaching a stump about six feet high, I disturbed a female of this species. She had a nest in a hole near the top of the stump and in it were five bluish eggs.

The American Goldfinch (*Astragalinus tristis,* Linn.) is another welcome visitor. I found a nest of this species in a bush by the road-side, on one of my early excursions on Mount Royal. It was beautifully formed, compact, and lined with down. In it were five white eggs tinged with blue.

When we lived at South Quebec, my wife purchased a young canary from a cottager at Hadlow. The woman said to her, "Here is a little bird I should like to give you. I bought it when it was a fledgling from a boy who had robbed a nest; and it has been brought up with the canary. The birds would be lonesome apart." My wife took it; it was a goldfinch and a great pet it has proved. In the spring it assumed its lovely golden dress—the *toga virilis* of its kind. This it puts off in its September moult.

When we moved to Hull the two birds were put in one cage which was wrapped in a shawl. When uncovered it was found that the goldfinch had been injured in one eye. It lost the sight of it. Then the other eye was affected, and it became totally blind. It seems to have become quite reconciled to its lot.

It is interesting to mark the tokens of perfect confidence it has in its mistress. It hears her voice; and it calls to her for its morning greeting. It comes to the

wires of its cage to welcome her. When it is time for its bath, of which it is very fond, she puts in her hand and it hops upon her finger and she places it in the water. When it has been in long enough she again lends it her finger and lifts it into its swing. There it shakes itself and preens its feathers till dry.

To give it occupation its mistress scatters some grains of hemp on the bottom of the cage. These are a great luxury. It turns its head sideways and gropes on the floor with open bill, and not a grain escapes it. It knows when its seed and water are changed and when a lump of sugar, a dandelion, a bunch of chickweed, or a stalk of plantain is placed in the wires of the cage for its delectation. It likes to be placed in the balcony where the busy twitter of the sparrows amuses it. It carols all the day and at night-fall it climbs to its swing and rocks itself to sleep.

I will speak of only one other bird, the Ruby-throated Humming Bird (*Trochilus colubris,* Linn.).

I found a nest of this bright and active little creature on a branch of a young birch tree which overhung a mountain rivulet. The structure resembled a knot of the tree and was covered with lichens and fragments of bark. From my station on the bank of the stream I could look down into the nest and see the two tiny white eggs. When the mother bird took her place on the nest the green of her upper plumage harmonized with the tints of the nest and its surroundings and made its disguise complete.

The male bird is a bold, dashing little fellow. He comes before you—his gorgeous breastplate flashing in the sun, and—*presto!* he is gone!

For the guidance of these, and other dependents on its bounty, a beneficent Providence hangs out gaily painted signs, to shew where stores of nectar may be had, by the thirsty without cost.

Insects.

The insects are "*in number numberless.*" Winn has given in his List—of Quebec Lepidoptera only, the names of 1,191 species. Lest I should weary you, I will confine my remarks to one genus only—that of *Catocala*—the beautiful Underwings.

The word Catocāla is often pronounced in the Old Country Catócala. The genius of the English language is to throw the accent back. We do not say Catastrōphe but Catas'trophe—though this word is also from the Greek.

The first Catocala I saw in Canada was in the maple wood on Mount Royal, which I have mentioned. I thought at first that it was the rare English moth, *Catocala fraxini,* Linn.—"the Clifden Nonpareil," but when it spread its wings I saw that I was mistaken; it had not the deep blue underwings of *C. fraxini.* It was *C. relicta,* Walker—"the Relict."*

I found *C. parta,* Guenée—"the Mother,' to be plentiful in Brome. This insect has scarlet underwings.

C. concumbens, Walker—"the Sleepy One," which has fine magenta underwings, was also rather common in the same locality.

C. cerogama, Guenée—"The Yellow-belted," I took on Cape Diamond, Quebec.

The beautiful form of *C. ilia,* Cramer, viz.—*C. osculata*—"the Beloved" I took in East Farnham, and there also I captured *C. subnata,* Grote—"the Youthful."

*The English names I use were those given by Holland, in his "Moth Book."

C. unijuga, Walker—"the Once Married," and *C. briseis,* Edwards, I took at Cowansville.

That beautiful moth *Catocala bianca,* Henry Edwards, I found at rest on a fence on the Heights of Abraham.

Some, if not all of these insects may, I dare say, be found in the lowlands, but all my captures of them were made in elevated regions.

I have spoken of the beauty of some of the living creatures that frequent our mountain districts. I will say in conclusion a few words on the lovely scenery that those districts present. I do not think I fully realized this till one day when driving from Waterloo to Magog (between which places a railway now passes) I met with John A. Fraser, the artist.* He was lodging at a cottage by the wayside, and was engaged in painting a view of Mount Orford and Orford Lake. He had portrayed the mountain as it appears at early morning, with the glow of the rising sun lighting up its higher projections, and contrasting finely with the deep shadows of its wooded recesses; while in the water below the charms both of colouring and outline were reflected.

But I think the most wonderful mountain view I ever witnessed in the eastern townships was an evening scene. To understand it you must remember that early in spring, before the buds open into leaf, the young twigs of the maples are deep red.

I was driving under the long western front of Gale Mountain, in East Farnham. The slope was clothed with maples from head to foot. The sun was setting in all its regal splendor over the low-lying French country; and its crimson beams struck full upon the ascent. The effect was marvellous—it can hardly be imagined. The whole slope glowed and sparkled with the lustre and tint of rubies. As I recall the scene the words in the Canticle—*Benedicite, omnia opera*—rise spontaneously to my mind, and furnish a fitting close to my address. "O ye Mountains and Hills, bless ye the Lord, praise Him and magnify Him forever."

THE PRESIDENT: I am sure I am voicing the feelings of all who are here when I say that we could not have enjoyed this paper with anything like the same degree of pleasure, had Dr. Fyles sent it to be read by someone else as an alternative to coming and reading it himself in his own inimitable way. We are so pleased to find from his paper that his pen has lost none of its beautiful descriptive power, and from the illustrations on the screen that his hand has lost none of its cunning. We hope that we shall continue to receive these papers from year to year as long as Dr. Fyles is able to give them to us. I have already suggested to him the subjects of two future papers for next year's meeting and that of 1916!

*John A. Fraser was an English portrait painter who came to Canada and worked for William Notman, the noted photographer of Montreal. Fraser became a charter member of the R.C.A. in 1880. He died in 1898. Two pictures from his hand are in the National Art Gallery of Canada.

EXPERIMENTS WITH POISONED BRAN BAITS FOR LOCUST CONTROL IN EASTERN CANADA.

ARTHUR GIBSON, CHIEF ASSISTANT ENTOMOLOGIST, DEPARTMENT OF AGRICULTURE, OTTAWA.

During 1914 we had an opportunity of testing out on a fairly large scale the value in Eastern Canada, of the Kansas formula for the destruction of locusts.* This formula which was originally experimented with by Mr. F. B. Milliken, when employed by the Kansas Experiment Station† consists of:

Bran	20 lbs.
Paris green, or white arsenic	1 lb.
Syrup (molasses)	2 qts.
Oranges or lemons	3 fruits.
Water	3½ gals.

In preparing the bran mash, mix the bran and Paris green, or white arsenic, thoroughly in a wash tub while dry. Squeeze the juice of the oranges or lemons into the water, and chop the remaining pulp and the peel to fine bits and add them to the water. Dissolve the syrup in the water and wet the bran and poison with the mixture, stirring at the same time so as to dampen the mash thoroughly.

Bran and Paris green with sweetened water had, of course, been previously used in the United States, as well as in Canada, for the destruction of locusts. In Fletcher's reports as Entomologist and Botanist to the Dominion Experimental Farms, frequent reference is made of the success obtained in the use of bran poisoned with Paris green. Near Douglas, Man.,§ where an application was made, he records having counted 117 dead locusts in 18 inches square. In 1901, Mr. Norman Criddle, now Field Officer of the Entomological Branch, co-operatively with the farmers in his immediate district used large quantities of bran and Paris green and enormous numbers of grasshoppers were killed. In the same year he tested out on a large scale the value of horse manure as a substitute for bran and this was found to be a decidedly better remedy. The day after the first application an average of 25 dead locusts was found to the square foot, while many more were dying.

Bran and arsenic have also been used in the control of locusts for many years. In 1885, Coquillett used a mixture of arsenic, sugar, and bran, to which was added a sufficient quantity of water to make a wet mash. This mixture was experimented with in California where about 300 acres of orchard and vineyard were treated, and in about two weeks after the application scarcely a living locust was to be seen, the ground in many places being covered with the dead insects. In 1888, bran, sugar and arsenic were used by Fletcher at Ottawa and large numbers of locusts were killed.

The results of the experiments conducted in Kansas in 1913 showed conclusively that the addition of the fruit—oranges or lemons— made the bait more attractive and appetizing, and consequently was eaten by more of the locusts. Prof. Dean, Entomologist, Kansas State Agricultural College and Experiment

*The species chiefly responsible for the destruction to crops was the Lesser Migratory Locust, *Melanoplus atlanis*. Associated with it, however, to a comparatively slight extent, was the Pellucid Locust, *Camnula pellucida*.

†For an account of this work see "Grasshopper Control in Western Kansas," by Geo. A. Dean, in *Journal of Economic Entomology*, Feb'y, 1914, p. 67.

§ Report Ent. and Botanist, Dom. Exp. Farms, 1901, p. 223.

Station, referring to the application of the mixture, states: "The damp mash or bait should be sown broadcast in the infested areas early in the morning, on about the time the grasshoppers are beginning to move about from their night's rest. It should be scattered in such a manner as to cover five acres with the amount of bait made by using the quantities of ingredients given in the above formula. Since very little of the bran is eaten after it becomes dry, scattering it broadcast in the morning, and very thinly, places it where the largest number will find it in the shortest time. Sowing it in this manner also makes it impossible for birds, barnyard fowls, or live stock to secure a sufficient amount of the poison to kill them. Inasmuch as the poisoned bait does not act quickly it will be from two to four days before the grasshoppers are found dead, and these will be more numerous in the sheltered places. It does not require much of the poison to kill them. Even a small portion from one of the poisoned flakes will be sufficient to cause death."

In view of the remarkable success in Kansas in the control of locusts, by adding to the poisoned bran the juice of lemons or oranges, the Entomological Branch decided to test out this remedy, near Ottawa, and also to experiment with other mixtures. These experiments were conducted at Bowesville, where a large section of the country is heavily infested with these insects. The results obtained were indeed very promising and would indicate that the Kansas formula, particularly when lemons are used, will be found of equal value in Canada, at least in the Provinces of Ontario and Quebec. In addition to the Bowesville experiments, applications were also made, under our direction, in Quebec Province near St. Etienne de Gres where locusts have been extremely destructive, and owing to which farms, on which the insects have been breeding for several years, have been abandoned.

The initial Bowesville experiments were conducted on the farm of Mr. Freeman, Sr., and we are particularly grateful for assistance received from Mr. Dowler Freeman. On June 18, I visited Bowesville and arranged to treat five different fields, of about four or five acres each, with the following mixtures:

Field No. 1—	Bran	20 lbs.
	Paris green	1 lb.
	Molasses	2 qts.
	Bananas	3
	Water	3½ gals.

Field No. 2.—Same as 1 with juice of 3 lemons instead of 3 bananas.
Field No. 3—Same as 1 with juice of 3 oranges instead of 3 bananas.
Field No. 4—Same as 1 but with no fruit and instead of 3½ gals. of water, 3 gallons and 1 half gallon of coal oil.
Field No. 5—Criddle Mixture.

These five mixtures were applied as soon after the above date as weather and time would permit. The locusts were very numerous and only a few, comparatively, had wings. The mixtures were broadcasted early in the morning and counts were made four days later in all the fields except that in which the mixture containing the oranges was used. Unfortunately, owing to a misunderstanding no counts were made in this field. The following are the results obtained:

Field No. 1—35 to 75 dead locusts to the square yard.
" " 2—50 to 414 dead to the square yard.
" " 4—Average 35 dead to the square yard.
" " 5—Average 50 dead to the square yard.

As regards the mixtures containing the fruit, that with lemons will probably give the best results. This fruit too is easily squeezed and of course, is cheaper than oranges.

As a result of these experiments, Mr. W. D. Jackson, the District Representative of the Ontario Department of Agriculture for Carleton County arranged to supply bran, molasses, Paris green and lemons—sufficient to treat 400 acres— to the farmers in the immediate district where the locusts were abundant. On June 30, accompanied by Mr. Jackson and his assistant Mr. Waterman, five farms were visited where it had been decided to apply the mixture. At this time the locusts were mostly in the winged condition although a number were still in the hopping stage. Within a week after the application counts were made diagonally across oat fields, etc., and these gave from 13 to 124 dead locusts to the square yard, the average being 57. The farmers of the district reported later that they were well pleased with the results of the experiment.

In addition to the Bowesville experiment at our request the Rev. J. I. Trudel and Rev. E. Fusey arranged to treat fields in their parishes, St. Etienne de Gres,

Fig. 19.—Corn Field, Bowesville, Ont., devastated by Lesser Migratory Locust. (Original).

and Valmont, Quebec, and in this Province even better results were obtained with the Kansas formula. Some farmers used lemons, and some oranges, and a stronger strength of Paris green was used, viz., 1½ lbs. to the 20 lbs. of bran. The Rev. J. I. Trudel reports that eight days after the poisoned bran was broadcasted counts were made in various fields and these gave from 900 to 1,200 dead locusts to the square yard. These results are certainly very remarkable. At the time of the applications the locusts had their wings and were migrating from one place to another.

In treating large areas with such a mixture, it is of the utmost importance in order to secure the results desired—that is the destruction of a very large percentage of the locusts—to make the applications while the insects are in the hopping stage and before they begin to migrate. Farmers should make special arrangements to co-operate and apply the mixture at the same time. This was done in Kansas and, as a result, from 60 per cent. to 80 per cent. of the insects were destroyed. Prof. Dean states: "The remaining grasshoppers were so left to the mercy of the parasitic and predaceous enemies that only a few of them escaped."

THE COST OF APPLYING THE KANSAS FORMULA.

At Bowmanville, Ont.

100 lbs. bran	$1 25
5 lbs. Paris green	1 25
2 gals. molasses	1 00
15 lemons	0 30
Labour, 6 hours	1 20
	$5 00

Applying 20 lbs. of the bran to 4 acres the cost comes to 25 cents per acre.

At St. Etienne des Gres, Que.

20 lbs. bran	$0 25
1½ lbs. Paris green	0 38
2 qts. molasses	0 22
Fruit	0 05
	$0 90

In this locality the 20 lbs. was scattered over 5 acres, the cost being 18 cents per acre, exclusive of labor.

Mr. R. Davey, of Tyrone, Ont., used the Kansas formula during the past season and he informs me that the cost was about 20 cents per acre.

THE PRESIDENT: This subject is naturally one of very great interest to Canadians, because locust control has become a very serious question with us in many parts of Canada. We were very fortunate in being able to make use of the results of the Kansas people and also in discovering that their formula gave such good results in the first season. It is particularly important in Quebec where it is not generally realized how serious the locusts are. I had a long conversation with Fathers Fusey and Trudel regarding the outbreak of locusts in the Three Rivers region, in the neighborhood of Valmont. In that region where the soil is sandy the results have shown that the mixture killed upwards of 1,200 locusts to the square yard. This shows not so much the effectiveness of the mixture as the abundance of the locusts in that region, and so serious are they that large numbers of farms have been abandoned and people are leaving the district. When a situation like that arises, locust control becomes a serious question, and is raised from being an interesting problem to the entomologist to an important economic question. Mr. Gibson has not mentioned the fact, but it may be interesting to those present to know that the Entomological Branch has also been carrying on some experiments in the use of the bacterial disease, the *Coccobacillus* of Dr. Herelle of the Pasteur Institute, Paris, France. Two years ago through the kindness of the Director of that Institute, I was able to obtain some of Dr. Herelle's culture from Paris, and last year (1913) Mr. Petch, who had charge of this work, carried out some preliminary experiments at the laboratory at Covey Hill, Que., where he found that the bacillus was pathogenic for Canadian species, which is interesting, but owing to the conditions we were not able to try it out on a large scale. We continued the experiments this year with the same results both regarding the *Coccobacillus* being pathogenic to our species, and in being unable to obtain results on a large scale. The failure of the experiments in the field was not so much due to the fact that the *Coccobacillus* cannot be utilized under field conditions, but to the fact that we had to send the bouillon culture so far from our laboratory. Our laboratory was in Quebec, and it had to be shipped to Montreal and thence to Ottawa. The conditions are such that the culture does not remain in a viable condition more than 48 hours.

Mr. Gibson: This year we were able to get it to the locality where it was tried out within 16 hours, and under ideal conditions.

The President: But unfortunately without good results. The failure may be due to the fact that we had to transfer it from the place of manufacture to the place where it is used. In its manufacture you have to carry out so many experiments. First it is necessary to inoculate one series of grasshoppers. Then you have to take the virus from them and to go through at least twelve series of grasshoppers, sometimes fourteen or sixteen. You then make the bouillon and this is used to prepare the final fluid. Next year all being well, I propose to move the seat of the experiments, if it can be arranged, to this district in Three Rivers, and have it right in the locality where the locusts are so abundant, in the hope of trying it out there. Whether it will be successful or not, it is difficult to say. It is claimed that they have had success with it in the Argentine and also in Northern Africa. But whether we can secure success in Canada remains to be seen. I do not think it will ever take the place of the Kansas formula, because its use necessitates the presence of a bacteriologist and bacteriological plant to manufacture the bouillon, and the facilities in regard to getting it away to outside points is somewhat limited. Unless therefore, there was an unusually severe outbreak which would warrant the locating of a laboratory of that kind, it might be preferable to use the more simple poisoned bran remedy.

Prof. Caesar: I have tried the Kansas remedy too, and have had a number of district representatives try it. They have all been well pleased. There are three little matters which I should like to refer to in connection with this. First in regard to the cutting of the pulp and rind of the lemons. If you run them through a meat-chopper it is handiest and the quickest way you can find. The second point is in regard to the amount of water. I myself used considerably less water than the Kansas people and Mr. Gibson. I only use two gallons where he uses three. I find that to be eminently satisfactory, and the reason I did it was because I had used the bran on other occasions and found that with a smaller amount of water it was easier to get the bran into the form of sawdust which form is necessary. It must go through the fingers easily. Third in applying it, it is not necessary to cover every foot of ground, because the grasshoppers move here and there. I made about 2½ gallons of it to over an acre. It will go over an acre and a quarter just as easily. Twenty pounds are sufficient for five acres. I take a handful of it and scatter it much as I should if sowing grass seed. It is not at all necessary to cover the ground uniformly. You may miss some here and there, and it makes very little difference. The number of insects you are going to get to each square yard depends entirely upon the number there are. I have never found so many as Mr. Gibson did. I think 120 was the largest number I got.

Mr. Criddle: As regards locust work in Manitoba, we have not used the Kansas bait yet owing to the fact that the locusts were scarce this year, but I find that a very important factor is that of temperature and, of course, moisture. I do not know whether it has been noticed here, but the grasshoppers in our district do not come out at all when the temperature is below 50 degrees. We have tried the poison bran on cold days but with no results. The hotter and dryer days gave the better results. In that respect moisture plays a very important part. In fact if you put out an ordinary pail of water and put in a little sugar to sweeten it, the grasshoppers will be attracted for at least fifty feet around and drown themselves in the pail. We have only tried the horse manure and bran and that sort of thing. In the case of horse manure in Manitoba, I have noticed horses go 100 yards or more

into a green field and leave droppings and presently thousands of grasshoppers would be there. That is where we originally got hold of the idea of using manure. I should like to ask whether such fruit as lemons, or other substances attract the grasshoppers in that way from a distance.

MR. GIBSON: In a recent paper published in the *Journal of Economic Entomology*, S. J. Hunter and P. W. Claassen gave an account of a number of experiments which they carried out in Kansas in placing out fruit juices to attract grasshoppers, and they found that they would come very considerable distances, attracted by the aroma of the fruit.

THE PRESIDENT: I was in Atlanta, Georgia, last year when these two papers were read by Professor Dean and Hunter, and they dwelt particularly upon the fact that it was the lemon that was the attractive quality, and they described, as you have, how many feet they would travel to reach it.

MR. CRIDDLE: I recently tried some experiments with sawdust in place of bran. Sawdust can be obtained for practically nothing in our district. In the ordinary way with salt added I got just about the same results as with bran. In Manitoba the grasshoppers have a habit of coming to anything which you may be holding attracted by the salty flavour left through contact with the hands. That induced me to try sawdust with salt added. It would be interesting to try further experiments along that line.

THE PRESIDENT: The plan which Mr. Criddle has suggested would be very useful in the Three Rivers District where you can get sawdust practically for nothing, and it is difficult sometimes to get either bran or horse manure. That would be a very useful thing for the farmers, and would cut down the cost considerably.

PROF. DEARNESS: I noticed a question raised in the reports as to the different kinds of fruit. It reminds me of the concession one of my pupils got at the World's Fair for selling Orangeade. He told me that he used about three oranges per barrel. The material he added to that was not directly allied to the oranges, and I think there was some cheap material that was added to intensify the effect of the fruit. It might be possible, in order to obtain greater acidulation, to use some cider or soured liquor of some kind. This might be experimented with with a view to getting something which would attract these insects still further. If there is any particular virtue in the lemon over the orange or banana, it would be either in the taste or in the odor and it would be a matter of experimentation to get something which would be better than either.

THE PRESIDENT: Either Prof. Dean or Prof. Hunter did carry out experiments with essential oils and chemicals of that kind which are the bases of the pungent qualities of these fruits.

MR. KING: I have used apples with the poison for the Fall Army Worm larvae and they have travelled towards the place, but I do not know whether that was due to the apples.

AN IMPORTED RED SPIDER ATTACKING FRUIT TREES.

BY L. CAESAR, O. A. C., GUELPH.

In the autumn of 1912, when examining the leaves of European plum trees that were severely attacked by what at first was supposed to be our common Red Spider, *Tetranychus bimaculatus*, though the mites themselves were not seen, my suspicions were aroused that it was some other mite and not *T. bimaculatus* that was

the offender. The reasons for these suspicions were: first, that the few unhatched eggs were red, whereas the eggs of *T. bimaculatus* are almost colorless; second, there was no visible fine web underneath the leaves as in the case of *T. bimaculatus;* third, the eggs were on both surfaces, being very common in the furrow of the midrib of the upper surafce; and, fourth, all the eggs were attached directly to the surface of the leaf. These last two characteristics are for the most part contrary to the habits of *T. bimaculatus.*

In 1913, having again found numerous trees affected in the same manner and the mites causing the trouble present in large numbers, I sent specimens to Mr. Nathan Banks of the Bureau of Entomology, Washington, D.C., who at first thought they were *Tetranychus mytilaspidis,* the Southern Red Spider, which attacks citrus trees, and which he supposed had escaped from the greenhouse. On sending further material with some account of the wide territory over which the mite was being found, together with its host plants, he answered as follows: "The red mite on the

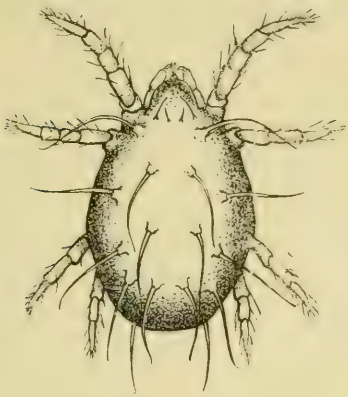

Fig. 20.—Imported Red Spider. (*Tetranychus pilosus.*)

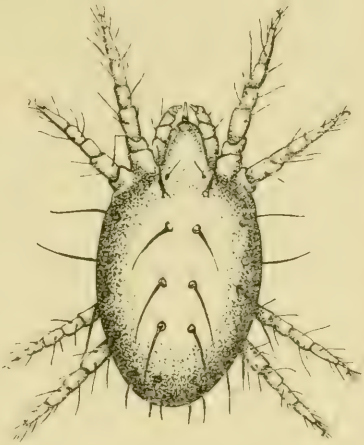

Fig. 21.—Common Red Spider. (*Tetranychus bimaculatus.*)

plum is the European *Tetranychus pilosus,* which occurs there on pears and other fruit. Its relation to *T. mytilaspidis* is very close and perhaps identical, but the latter species has been only known to us from the south and mostly on oranges." He stated further that this was the first record of *T. pilosus* in America and asked for more material and data, which were at once forwarded.

Description of Appearance of Tetranychus Pilosus as Seen Under a Hand Lens.

The mites are about the same size as *T. bimaculatus,* but are stouter and more nearly circular in outline of body. Unlike *T. bimaculatus,* the females are apparently always, even in the immature stages, red in colour. The mature females are dark red, some being decidedly blackish, but the mouth parts and often a median dorsal longitudinal area, especially on the posterior half of the body, are paler red. The ventral surface is paler than the dorsal. The legs are whitish, tinged with red. On the dorsal surface are a few small, whitish tubercles arranged in parallel rows. Four longitudinal rows with three tubercles in each can easily be seen. There are, however, more tubercles but not easily made out with a hand lens. From each tubercle

a fine, whitish hair or bristle arises. The legs, as in the case of *T. bimaculatus,* do not differ much in length. The front pair is held extended in front of the body when at rest.

From this description it will be noticed that the easiest way of distinguishing this species from *T. bimaculatus* is the presence of the whitish tubercles on the dorsum, each with its fine hair. These tubercles are not present in the latter species.

Copulation was not observed, but smaller, more slender, adult mites, evidently males, were frequently seen caressing females after the manner of the males of *T. bimaculatus.* These resembled very closely the males of the latter species, and were yellowish-white anteriorly with darkened abdomen, sometimes strongly tinted with red.

Distribution in Ontario.

I have found the mites very widely distributed through the Province from Prince Edward County on the east to Lambton County on Lake Huron on the west, and from Guelph in the north to St. Catharines in the south. There seems, therefore, very litle doubt that further observations will show that they occur all over the fruit growing parts of the Province.

Food Plants.

Up to the present this Red Spider has been found on European plum, apple, sour cherry, pear, peach, hawthorn, mountain ash and rose. It probably occurs also on sweet cherry and Japanese plum. The favorite host plant by far is the European plum, and in searching one is always sure to find it on the leaves of this tree if present anywhere in the orchard. The apple is apparently the next choice, and then sour cherry. Pears, peaches, mountain ash and roses are very little attacked in my experience, and Japanese plums alongside European varieties have apparently been untouched. A few hawthorn trees have been badly attacked, but these seem to have been exceptions rather than the rule. No other plants have so far been seen to be infested.

Nature and Extent of the Injury.

The injury is caused in the same way as that of the Red Spider, *Tetranychus bimaculatus,* and resembles this to a large extent. Feeding, however, takes place on both surfaces of the leaves. Badly infested plum and apple foliage looks at a distance as if it had been covered with very fine road dust. On closer examination it can be seen that the upper surface of the leaves is studded thickly with fine whiteish blotches. With the further feeding of the mites many of the leaves turn brownish, thus giving the foliage the dusty appearance just referred to. Whole plum, and in a few cases, whole apple orchards, have been affected in this way. Often, however, only a few of the trees are severely attacked, and sometimes very little damage is done. Some seasons the mites are much worse than others. They were worse last year at Guelph and in Niagara than this year. It is difficult to estimate how much damage even a bad infestation causes. Perhaps as much as one should say is that it must interfere considerably with the function of the leaves in manufacturing food, and so weaken the tree and lessen its power of producing large crops of good sized fruit. It is not probable that the mites would ever kill a tree though they might so weaken it that it would succumb to a very severe winter. It can, however, safely be said that on fruit trees this is at present much the most destructive of the Red Spider type of mites in Ontario.

How Long the Mite Has Been in Ontario?

The chief means of distribution is doubtless on nursery stock and by birds and flying insects. These agencies may soon distribute a pest over a great deal of territory, but from the fact that the Blister Mite (*Eriophyes pyri*), though known in the province for many years and distributed in the same manner, has not yet reached nearly all our orchards, it seems clear from the wide distribution of this mite that it is no recent importation, but has been here for many years and has hitherto been mistaken for the Red Spider, *T. bimaculatus*.

Life History So Far As Observed.

The winter is spent in the egg stage. The eggs are small, globular and blood red, and are deposited in great abundance in the axils of branches and twigs on infested trees. Many eggs were found also in the calyx and stem ends of apples. Egg laying was observed this year (1914) on October 7th, but many had been laid before this date. Not a few adults were still present at the above date on the leaves. Until last year (1913) the writer had supposed that these eggs had all been deposited by *Bryobia pratensis*, but having actually seen *T. pilosus* laying the eggs, and noticed that infested trees regularly had these eggs whereas uninfested ones were almost without them, he is convinced that so far as Ontario is concerned the most of these eggs are laid by this new species, and not by *Bryobia pratensis*.

It may be worth mentioning that as soon as a female of *T. pilosus* deposited an egg she spent approximately a minute in fastening a few silken threads to or or over it, apparently with the object of holding it in place. *T. mytilaspidis* has, I believe, the same method of attaching her eggs.

At Guelph this year the eggs hatched about the time the leaves on the European plums were expanding viz. about May 15th. The exact date was not determined, but it was some time after the buds had burst. On May 23 little, immature, red mites were found and brought into the laboratory. By May 27th these had become adults and were then easily identified. By May 28 a few eggs were laid on the leaves of a well sheltered European plum tree in the writer's garden. The winter eggs had probably hatched earlier on this tree than in the average orchard.

No study was made of the length of the incubation period of the eggs, nor of the larval stages or number of generations a year. It is evident, however, from the rapid rate of increase that there are many generations and breeding continues right up to the cold weather in autumn. The severe frosts then evidently kill off all the adults.

Control.

A tree badly infested in the early part of this summer was seen to be almost free from mites in August. It was also noticed that in the Niagara district the mites were not nearly so numerous as last year, whereas in Norfolk County they were still very abundant in October. It is, therefore, apparent that there is some natural means of control that is very helpful, but what this is was not discovered. A year ago when the mites were very abundant on an isolated European plum tree the writer had this thoroughly sprayed with the ordinary summer strength of lime-sulphur, the spray being applied to the under surface of the leaves. The result was very satisfactory. It is very probable, therefore, that where orchards are badly infested the mites can be controlled by using lime-sulphur instead of bordeaux mixture for the

ordinary sprayings and giving an extra application about August 1st or as late as safe before the fruit is ripe. It is clear, however, from the presence of the mites in scale infested areas where strong lime-sulphur is used before the buds burst, that this mixture will not destroy the eggs.

PROF. DEARNESS: I should like to ask how the eggs of *Bryobia pratensis* can be distinguished from these of this new species.

PROF. CAESAR: There does not seem to be any way of distinguishing them.

PROF. BRITTAIN: Has anybody noticed in Ontario or the Maritime Provinces that so called rusty leaf or silver leaf mite? It has occurred in British Columbia causing this silvery appearance on the leaves to be mistaken for a disease called Silver Leaf. When I left British Columbia, I took with me Northern Spy nursery stock which had these incrustations. It makes very unsightly looking nursery stock. This year the mites came out proving it to be the same species. It makes these incrustations and spoils the appearance of the bark. It does not do any harm. They do not seem to flourish in British Columbia, but they have found mites of the same species in King's County, so they are apparently found there too. It is well distributed in North America, in Washington, Oregon and New York State, so there is nothing surprising about it. There is another mite in British Columbia which makes its appearance on leaves. It causes raised blisters, black in colour or very dark. The mites are on the under side hidden among the hairs and are never found much unless you look with a microscope. I saw some leaves on apple trees with marks which looked as if they might be there. Has anybody found that mite in Eastern Canada? I have seen botanists deceived by it more than once, thinking they had the apple scab. In fact it has been diagnosed as apple scab frequently.

THE PRESIDENT: Mr. T. Jarvis is more of a specialist on these mites, but that question as to the Phytoptid mite is very interesting. Prof. Crosby is probably interested in the matter because he may have had similar experiences. Three years ago Mr. Güssow, the Dominion Botanist, and I first received specimens of this northern spy nursery stock from the Coldstream Nurseries in British Columbia bearing these reddish brown incrustations to which Prof. Brittain has referred. I am not sure, but I think the stock at the time was being condemned as being diseased and not fit for sale, and it was sent up to have the disease determined. I looked into the matter personally and examined quite a number of these young seedlings, and found the characteristic small tubercles which are caused by the *Empoasca* when it deposits its eggs. I found the egg of this insect and naturally assumed that this was the cause of the trouble. The next spring we reared the larvae of *Empoasca mali* from the tubercles which later took the form of incrustations where the bark was ruptured. At that time the silver leaf on the apples in British Columbia was attracting attention. I do not know whether it was Prof. Brittain himself or in conjunction with Mr. Güssow, who discovered that there were two kinds of silver leaf, one caused by the *Stereum* and the other caused by the little Phytoptid mite which I believe also causes silver leaf in peach, I think the original record from North America was on peach. Later we had further samples sent of these seedlings bearing incrustations. Mr. Dash of the Provincial Horticultural Department found these Phytoptid mites under the brown incrustations which we said were due to the emergence of the *Empoasca* larvæ. We corresponded about the matter each referring to the same thing though believing the other meant something different. Finally when we found that both of us had been talking about the same thing, the whole story worked out in this way. The *Empoasca* deposits egg under the surface of the bark which is ruptured when the larva emerges. This rupture increases in size with

the growth of the tree and forms a brown incrusted area the under surface of which is then invaded by the Phytoptid mites, and these eat away the tissues underneath the bark and in that way separate the bark and cause the spreading of these brown incrustations which are not therefore really produced by the *Empoasca*. In that way the whole story was brought together.

It is most interesting to find that Prof. Brittain has discovered it in Nova Scotia. There is a very great deal to be learnt regarding these various forms of mites.

PROF. BRITTAIN: The mark caused by the mites has a very much more metallic appearance. The lustre is more metallic, while the other has a softer gloss.

THE PRESIDENT: They hibernate under that incrustation in enormous numbers.

CHERRY FRUIT FLIES.

L. CAESAR, O. A. C., GUELPH.

In 1910 as the result of a complaint about insects attacking a cherry orchard at St. Catharines, I found that the pest was *Rhagoletis cingulata*. In 1912, when examining another orchard near by *R. fausta* was discovered.

1. *R. fausta* has a black abdomen. *R. cingulata* has white cross bars on the abdomen.

2. The markings on the wings are quite different.

Fig. 22.—A female Black-bodied Cherry Fruit-fly (*Rhagoletis fausta.*) Note the arrangement of the dark markings on the wings, and also the black abdomen without white crossbands.

Fig. 23.—A female White-banded Cherry Fruit-fly (*Rhagoletis cingulata.*) Note the arrangement of the dark markings on the wings, and the presence of white crossbands on the abdomen.

DISTRIBUTION OF THE FLIES.

R. cingulata in Canada has apparently been reported only from Ontario. In Ontario it is found in a number of orchards and gardens from Oakville to Niagara Falls, a distance of about 75 miles. Either it or *fausta* occurs at Cobourg and probably at Berlin. *R. fausta* has practically the same range in Ontario fruit districts, but has also been found in British Columbia and on one occason in North Ontario at Kearney. It has not been reported from any other part of Canada and is very scarce in British Columbia.

R. cingulata is on the whole the more abundant, but there are many exceptions. Some badly infested orchards will have 99 per cent. *cingulata*, others within two miles 99 per cent. *fausta*.

Food Plants.

Sour cherries, especially Montmorency and Morello, are the favorites, but late sweet cherries are also infested. Early Richmond (a sour variety) and early sweet cherries are only to a very small extent injured, probably because they are nearly ripe before the eggs are laid and because the flies prefer to lay eggs in green cherries or those just beginning to turn. Wild sweet cherries, offsprings of cultivated sweet varieties, are also attacked, but no other kinds of wild cherries were found with any maggots in them.

Nature and Extent of the Injury.

The injury is caused by the larvae—little white maggots—tearing the pulp around the pit with the hooks that serve as jaws and absorbing the juice. This soon renders the interior unsightly and the cherry unfit to eat. The surface above where the feeding is done often collapses. Wormy cherries are subject to the Brown Rot disease, and then spread this to neighboring cherries. Moreover the sale of wormy fruit spoils the market for good cherries.

Many orchards in the Niagara districts are infested. In some the loss is very small, in other it is very great. About one dozen fair-sized orchards have been visited that had each from 30 to 90 per cent. of the fruit wormy. There is no doubt at all that the insects are very important and need to be combated.

The Plum Curculio larva has a distinct brown head, and a stout curved, creamy white body. The Cherry Fruit-fly larva has no head, a pair of black hooks taking the place of a head. The body is not curved and tapers strongly towards this end, the anal end being blunt. The colour varies from glossy white to light yellow in both species.

The adults of *R. fausta* begin to emerge in Niagara the first week in June, that is a few days before the early Richmond cherries have begun to show any red. *R. cingulata* adults are approximately a week later, not beginning to emerge until about the 10th or 12th. The majority of *R. fausta* came out this year between June 8th and 13th, and of *R. cingulata* between June 16th and 21st, that is a little over a week later.

The average length of life of both species is a little less than one month, possibly not more than three weeks. A few adults, however, live somewhat longer. There are more females than males, though towards the end of the season there are at least five males of *cingulata* to one female. This is not true of *fausta*, the females being in the majority even late in the season.

Length of Time From Emergence to Egg Laying.

This is difficult to determine, but from a number of experiments was found to be somewhere between ten and fourteen days.

The eggs are laid by the sharp sting-like ovipositor just beneath the skin. They can easily be seen with a hand lens by cutting across the cherry just below the surface. Eggs of both species are white and nearly elliptical. In large cages 44 larvæ were the most obtained from any one fly, but a dissection of mature ovaries showed as many as 240 eggs either fully formed or clearly distinguishable. Others would doubtless be formed as these were being laid. It would not be surprising if one fly laid 300 eggs or more. The operation of laying requires less than thirty

seconds on an average. In one case a female laid five eggs in thirty minutes. Punctures are often made without any eggs being laid, for instance 42 punctures were found in one cherry in the orchard, but only five eggs deposited.

The eggs hatch in warm weather on an average in five days. Sometimes only four days are required, but in colder weather this is not infrequently increased to eight days.

Number of Larvæ in a Cherry and Length of the Larval Stage.

It is claimed that there is only one larva to a cherry, but we found as high as four in one instance, three in several others, and two in many cases. One is, however, the usual number.

The larval stage varies with the rate of the ripening of the fruit after the egg hatches. In July it is about 13 or 14 days on an average. In colder weather it may be three weeks.

In most cases the larvæ, when they are half grown or more, make one or sometimes two little holes in the skin of the fruit. These are supposed to be for breathing purposes.

Pupation.

As soon as they are full grown the larvæ come out of the ripe fruit, drop to the ground and at once seek to enter it. Having done this they contract the anterior and posterior segments to form the puparia, and after the lapse of some time change to the pupæ inside these.

The usual depth is about one inch where the soil is soft and well cultivated, but in cracks in hard soil they go several inches deep. Sometimes in hard soil, covered with grass, puparia are to be found almost on the surface in among the roots and protected by these from the sun.

The puparia of *fausta* are whitish or cream colored; those of *cingulata* brown. This may not be true just at first, but is after the lapse of some weeks.

It has been proved in Ontario as well as in New Hampshire that the Apple Maggot may remain through two winters in the pupal stage before emerging. We have not had an opportunity to test this with the Fruit Fies, but observed that some pupæ, which did not emerge in the summer, were still healthy in the autumn. This suggests that it is possible a few do remain in this stage two seasons.

Natural Means of Control.

1. Ants destroy many freshly emerged adults before their wings can become developed. They also capture many larvæ after they leave the fruit and before they can enter the soil.

2. Spiders capture a number of adults.

3. Birds, including poultry, feed on pupæ and larvæ on or in the ground.

4. Numerous larvæ, where the surface is hard, fail to enter the surface and die from exposure to heat or fall a prey to ants or other predaceous foes. Pupæ must have protection from sun and dry atmosphere.

Control by Spraying.

The flies can easily be controlled by two applications of a sweetened poison on the fruit and foliage. The first should be made as soon as the earliest adults are seen, which in Niagara is the first week in June, or about a week before the early

Richmonds begin to show any red; the second about 10 or 12 days later. The mixture we used was 2½ to 3 lbs. arsenate of lead to 40 gallons of water, sweetened with nearly one gallon of molasses (black strap). The nozzle on the spray rod was moderately coarse, and care was taken to cover the underside of nearly all the leaves as well as the upper side. We believe in spraying fairly well so that very few leaves are missed, but not in drenching the trees. It takes very little time to cover 100 large trees which are close together. The total cost for the mixture, labour and all, is about five cents per tree.

It was found that, owing to rains, one application was not sufficient in the ordinary season, though it lessened the percentage of wormy fruit greatly.

Arsenate of lead will, without the molasses, control the pests, but it is advisable to use the molasses, because the flies are very fond of sweet substances. If the treatment is repeated two years in succession, it should free the orchard for many years, provided there is no nearby infested orchard. Useless cherry trees should be cut down and burned. Neighbors should also be asked to co-operate.

Tests with Sweetened Poisons and with Arsenate of Lead Alone.

In 1913 an orchard of 183 trees was sprayed twice, June 13th and 23rd, with 3 lbs. arsenate of lead to 40 gals. of water, sweetened with 1 gal. molasses. This orchard had been so badly infested the previous year that much of the fruit could not be picked. Numerous flies emerged in 1913. In one cage, 4 x 1½ ft., a total of 38 flies emerged from the ground, showing that the infestation was abundant. From six trees 175 were captured in between two and three hours by Mr. Spencer and myself.

Result.—In a little more than a week from the second application very few flies could be seen, and at picking time a crop of $1,000 in value was harvested without either the pickers or ourselves finding a single wormy cherry, though an orchard less than quarter of a mile away under the same kind of cultivation was so badly infested that less than half the crop was harvested. The variety was Montmorency.

A second orchard on the same farm, consisting of 91 sour cherries planted among plums, peaches and early sweet cherries, had the east half sprayed, the west not sprayed.

Results.—Unsprayed, 10 to 40 per cent. wormy; sprayed, 1 to 13 per cent. wormy. It was clear that the flies flew about from tree to tree to a greater extent than was usually supposed.

In 1914 one orchard of 140 late sour cherries was sprayed on June 8th and June 23rd with the same mixture as above. This orchard had been very badly infested by *R. fausta* the previous year, and scarcely any cherries picked. It had been well cultivated. Numerous flies emerged and pupæ were easy to obtain.

Results.—The flies were very scarce in about 10 days after the first application, and never became abundant for any length of time. In a sheet spread on June 10th under one tree 70 dead flies were captured, most of them in the first 8 days, June 11th to 18th. At the time of picking none of the pickers found any wormy fruit, nor did my assistant. The owner's wife found a very occasional worm when storing the fruit, but so rare that one could not easily state it in terms of percentum. A few unsprayed trees several hundred yards away had 75 per cent. wormy.

A second orchard of 180 trees, chiefly Montmorency, received two applications, the first on June 13th, with the same sweetened poison, and the second on June

20th, with arsenate of lead alone, 3 lbs. to 40 gals. of water. This was so badly infested that cages on the ground indicated that nearly 700 adults emerged to a tree in parts of the orchard.

Results.—The flies were never seen copulating or egg laying, and at picking time the Montmorencies were entirely free from worms. May Duke and Morello had much less than one per cent. wormy fruit on the worst infested trees. It is believed the flies that laid these flew in from a few badly infested trees about 200 yards away.

Check orchards not any worse infested the previous year showed 30 to 95 per cent. of wormy fruit.

Important Points to Remember.

1. The spray must be put on early enough to kill the flies before they are old enough to lay eggs. They begin to lay in about 10 days, therefore great promptness is necessary.
2. All those who tried to control the pest with one application where it had been bad the previous year failed, hence two are necessary.
3. Cultivation is useless as a means of control.
4. Useless cherry trees should be cut down and burned.
5. The co-operation of neighbors should, where possible, be secured.

The President: I am very pleased that Mr. Caesar gave us this account of the conclusion of the work on the fruit flies, of which we have had interesting accounts from year to year. He did not mention anything about the distribution of the fruit fly elsewhere.

Prof. Caesar: I wrote to British Columbia a year ago, and they have no report now of any orchard in which either of these species is present. The black-bodied species was originally discovered in British Columbia. Mr. Good, who has been in Nova Scotia and is now working with Prof. Brittain, says that he has seen none in that province.

Prof. Brittain: A Mr. Chesley Allan sends a report and says that he has found a cherry fruit fly, but they would not let him have it. I told him that the next time I went down I would look it up.

The President: It would be likely to occur there on account of the large number of cherries grown there. I am almost sure that it occurs in Quebec. There is a dipterous larva which affects cherries down there. I should like to ask you by what means you differentiate the different larvae?

Prof. Caesar: The larvæ may be separated by the little hooks. Mr. Spencer has worked on this a good deal and he finds that on the concave surface, the under surface, there is a little projection or lobe in one species not found on the other. There are apparently some other very minute differences in the structure of the cephalopharyngeal skeleton.

The President: Did he compare the characters of the anal spiracles?

Prof. Caesar: Yes, but they do not help. It is very hard to distinguish the larvae, no matter how carefully you examine them, even under microscope.

The President: You said that the adults lived up to about a month; how did you keep them?

Prof. Caesar: We enclosed whole trees in cages.

The President: Did you try to keep the adults in tubes?

PROF. CAESAR: Yes, but it was not satisfactory. A very hot day hastens their death. We could not get ideal conditions.

THE PRESIDENT: My experience with Muscid flies in keeping them alive is strange. You would expect that the larger the cage the longer you could keep them alive.

PROF. CAESAR: That was the case with the Cherry Fruit-flies in our experience, small cages were very unsatisfactory. Our cages enclosed the whole tree.

THE PRESIDENT: The converse was true in my experience. I found that in the case of such flies as *Stomoxys* the way to keep them alive longest is to keep them in glass tubes, 6 to 8 inches long, with absorbent wool stoppers.

PROF. CAESAR: I might add that we watered these cages every day that there was no rain.

THE CONTROL OF FOREST AND SHADE TREE INSECTS OF THE FARM.

J. M. SWAINE, ASSISTANT ENTOMOLOGIST FOR FOREST INSECTS, OTTAWA.

The beauty and comfort of any farm home depend to a not inconsiderable degree upon the shade trees which surround it; and yet we see many farmhouses, even in Eastern Canada, quite without shade trees of any kind. Such places are usually unbearably hot in summer, and unspeakably dreary in winter. A few fine shade trees would make a wonderful change. It is, however, rather with the preservation of the trees that occur that this society has to do. The most serious enemies of shade trees in this country are certain insect and fungous pests and heavy wind or sleet storms. The injuries from these sources are closely related. In many cases parasitic fungi, the cause of wood decay, gain entrance to the wood through tunnels of boring insects; fungus-injured branches and trunks provide breeding grounds for many insects; and insects, and particularly parasitic fungi, enter through storm-injured branches and wounds in the trunk.

It is possible to control most insect and fungus outbreaks on trees which are valuable enough to warrant individual treatment; but very many of these injuries could be prevented by proper handling of the trees, and considerable expense and trouble could thus be avoided.

Mistakes are made often in selecting the trees for planting. Good stock should be chosen of varieties which are suited to the climate and soil conditions of the location. Trees which are likely to succumb to local insect pests should be avoided. It is almost useless, for instance, to plant the imported cut-leaf birches in districts where the Bronze Birch Borer is abundant, or the black locust tree in regions infested by the Locust Borer.

The trees should be planted carefully and properly. Unless used for hedges, wind-breaks or close clumps, the individual trees should have sufficient room to develop the normal shape.

A good fertilizer should be applied when it is needed, and an abundance of water should be furnished to the roots in dry seasons. The weaker, unthrifty trees should receive special attention. Numbers of our bark-boring and wood-boring insects, which normally breed in dying trees, will attack trees in an unhealthy condition, particularly when the insects are present in great numbers. Other

species which are notoriously destructive to healthy trees prefer weakened bark and wood, and attack it most readily; this is true, particularly, of numbers of bark-beetle species. Vigorous trees in full sap are much better able to withstand the attack of some of these destructive borers, and are of course more likely to recover from attacks by defoliating or sucking insects, or from injuries of any sort.

We have numbers of inquiries each season with regard to dying branches of conifers. When these trees are grown in a close stand they normally lose the lower branches as the dense growth of the crowns above gradually cuts off the supply of light. This is certain to occur if the trees are close together, and does not indicate an unhealthy condition. It is possible to retain the beautiful conical shape of the spruce, for example, only when the light has free access to all parts of the tree. Spruces are commonly seriously affected by gall aphids, and often lose many branches from this cause. It frequently happens, however, that several branches will die in a season on apparently healthy isolated spruces. The needles turn yellow during midsummer and drop; small portions or entire branches may be affected. There is no insect and apparently no fungus injury, and the trees otherwise appear to be quite healthy. This trouble appears to be more in evidence during dry seasons, and it is probably due to lack of sufficient moisture.

Protection from injuries, and the proper treatment of those received, are of the utmost importance. Whenever the bark is broken and left untreated, insects and fungi are almost certain to gain entrance. Many of the most serious injuries from decay originate from neglected wounds through which the parasitic fungus enters. All such wounds should be properly cared for. The broken branches and those to be pruned should be cut off even with the trunk; wounds on the trunk or limbs should be trimmed smooth; and all such cut surfaces should be disinfected with creosote or bichloride of mercury solution and coated with coal-tar or good paint. Any needed pruning is best done during the dormant period of the trees, while the sap-flow is not sufficient to break through the coating on the wounds. Injury from wind and sleet storms can be lessened by chaining or bolting weaker upright branches together or to the trunk. Reasonable care in the prevention of injuries, and in the proper treatment of those which occur, will prevent much trouble from insects and fungous rots. Trees which have been badly injured by decay can be saved in many cases by proper surgical treatment. The decayed portions should be entirely removed and the healthy surface thus laid bare, disinfected with creosote or a solution of bichloride of mercury, and then painted with coal-tar or good paint. The parts should then be bolted together, if such support is required, and the cavity filled with cement. It is best to have any important work of this kind done by an expert in tree surgery, if such services are available.

Clean Culture.—All dying and dead branches and trees should be removed and burned. Many insects and rot-causing fungi breed in such material and emerge therefrom to attack weakened or even healthy trees or branches. *It is of the utmost importance to cut out or collect all such material promptly and burn it so as to destroy the pests which it contains.* Make it a rule to remove and burn dying wood as soon as it is detected, and each fall or winter remove all dying and dead trees and parts and burn them before spring, so as to destroy the pests which they contain.

General Methods of Control.

The chief injurious insects included here may be grouped as defoliating insects, sucking insects, and borers in the bark and wood.

Most leaf-eating insects may be controlled readily enough by the ordinary poison sprays of paris green or lead arsenate. Very strong mixtures are at times required, and it is sometimes advisable to employ a spray of strong contact insecticide as a more rapid control for hordes of caterpillars. Very young Tent Caterpillars, where in immense numbers, are best controlled in this way.

Sucking insects are controlled by spraying with strong contact insecticides, such as kerosene emulsion, fish-oil soap, and good tobacco extracts.

The spraying of shade-trees requires the insecticides and, in general, the methods employed in the spraying of orchard trees; except that we have to reach greater heights, and in such cases need a more powerful apparatus. For spraying the lower foliage the ordinary nozzles and equipment are used; but to reach the top of the higher trees it is necessary to employ a solid stream and a power-sprayer of large capacity. A few of the power spray-pumps sold for orchard work will maintain a solid stream for 60 feet from the nozzle; other pumps, excellent for general work in the orchard, have a small pump capacity, and are unable to maintain a solid stream above 40 ft. By using a good "solid stream" nozzle, such as the Worthley, and elevating the nozzle on a platform or ladder, the average orchard power-sprayer can be made fairly effective for shade-tree work. For towns and cities where large numbers of tall trees are to be sprayed a special power-sprayer for shade-tree purposes should be obtained. Such pumps are now available, capable of maintaining a solid stream from 80 to 100 feet up from the nozzle.

Spraying for shade-tree insects should be thorough. A mist spray at high pressure should be employed for as high as the extension will reach; and for the higher portions the solid stream is necessary. The latter uses the spray mixtures very rapidly and should be employed with discretion. It is, of course, quite necessary to understand the habits of the insects to be controlled and to make the sprays at the proper time.

Hand-picking is effective to a very limited extent. The tents of the American Tent Caterpillar can be removed by means of tree-trimmers or torches; egg-masses of the tent-caterpillars and the tussock moths can be removed by hand at times with profit; and the larger caterpillars, which rarely occur in great numbers, can sometimes be removed from low foliage by hand more cheaply and effectively than in any other way.

The Destruction of Larger Borers: When living trees become infested with large boring grubs or caterpillars it is necessary to kill the borers within the wood with the least possible injury to the trees. When the borers are near the surface it is often possible to cut them out with a knife or chisel without much injury to the wood; or a wire thrust into the borings can sometimes be used effectively. It is usually possible to kill the grubs by injecting carbon bisulphide or benzine into the openings. The fluid should be injected with a syringe or oiling can, and the opening should be immediately closed with soap or putty. After several hours the plug should be removed and the grubs extracted if easily reached, decaying wood cut away, and the holes thoroughly syringed with strong lime sulphur or copper sulphate, or with a solution of bichloride of mercury, and finally filled with cement or putty. The fluid should be injected into the flatter holes from which sap and borings have been oozing, and which evidently lead to the tunnels of living larvæ.

It is useless to inject insecticides into the exit-holes, from which the adults have escaped, although such holes should be disinfected and filled with putty or cement.

Banding the trunks of deciduous trees to prevent infestation from wandering hordes of tent-caterpillars or the wingless females of the canker-worms is often a necessary precaution. The most effective method is to make a complete girdle about the trunk with a sticky substance over which the insects cannot crawl. The adhesive should be applied in a band about four inches wide to stout paper tacked or tied about the trunk five or six feet from the ground. If the bark is uneven cotton should be placed beneath the paper to prevent the insects passing beneath. One of the best adhesives for banding is made by boiling resin and castor oil in equal parts and thoroughly mixing. The well-known preparation "Tree-tangle-foot" is widely used for this purpose.

Danger of Insect Importations.

The shade trees of the Eastern States are infested by several very destructive insect species which have not yet become established in Canada. The Brown-tail Moth has unfortunately gained a foothold in Nova Scotia and New Brunswick, but is being successfully held in check. Flights of the moths from infested districts in Maine have been responsible for the infestations. The Gipsy Moth spreads much more slowly, and is not yet known to be breeding in any part of Canada.

The Elm Leaf Beetle, *Galerucella luteola* Muller, is a most deadly enemy of the elms throughout many parts of the Eastern States. It has not yet been reported as injurious in Canada; it occurs, however, throughout the northern and western part of New York State and the country adjacent to Lake Ontario, and we may expect it in the Niagara Peninsula before many years.

The adult beetle is about one-fourth of an inch long, reddish-yellow or greenish-yellow in colour, with three black spots on the prothorax, and usually three black stripes lengthwise on the wing-covers. The adult beetles eat irregular holes in the leaves, and the grubs eat away the under surface of the leaves, which rapidly dry and turn brown. This species has killed great numbers of elm trees throughout its range. It can be controlled by poison sprays; but would, without doubt, create havoc if it were to become established in Ontario or Quebec.

In recent years the elms about Boston have been attacked by the Elm Bark-beetle, *Eccoptogaster multistriata* Marsh. This small species is a most important enemy of weakened or unthrifty trees. The adults are black and about 1-8 inch in length, with a short snout. They are easily distinguished from the common, and less injurious elm snout-beetles, which are very distinctly larger and have a long, slender snout or proboscis. The adults of the Elm Bark-beetle bore round holes through the bark and cut egg-tunnels along the surface of the wood. From the eggs, laid along the sides of these egg-tunnels, the larvæ or grubs hatch and excavate individual galleries away from the egg-tunnels through the inner bark. After pupating in the ends of these larva mines, and transforming to adults, they cut small round holes thorugh the bark to freedom. A discovery of these small black beetles with their whitish grubs beneath the bark of dying elms should receive immediate attention.

The Hickory Bark-beetle, *Eccoptogaster quadrispinosus*, a much larger species of the same genus and with similar habits, is a destructive enemy of hickory trees as far north as Lake Erie. It has not been recorded as injurious in Eastern Canada: but I have specimens taken in Southern Ontario, and we may find any summer that it has obtained a foot-hold in the Niagara Peninsula.

The Leopard Moth, *Zeuzera pyrina* Linné is another very destructive enemy of deciduous shade-trees which may eventually spread northwards. Its large caterpillar excavates tunnels in the wood, and has become a very serious pest throughout the region between New York and Boston.

All these species, with the exception of the Hickory Bark Beetle, were imported from Europe in various ways and at different times. It is quite possible that some definite minimum temperature will determine the northern limit of their range; but it is probable that most of them will breed readily enough in Southern Ontario. It is well, therefore, to be familiar with the appearance and habits of such possible enemies, for the successful eradication of an infestation could only be accomplished at the very inception of an outbreak.

The Injurious Insects of the Woodlot.

We have been dealing thus far with the shade-trees or ornamental trees of sufficient value to the owner to warrant individual treatment.

It is quite another matter to control the insect enemies of woodlands, chiefly for the reason that we have here so many trees to deal with that individual treatment, such as spraying, usually involves an unreasonable expense. The insects involved will be those which affect indigenous shade-trees, and they may be controlled by the same methods, limited always by the factor of expense. It might, for instance, be worth while to control a serious outbreak of defoliating insects in a valuable sugar bush by banding or even by spraying the trees, having in mind the serious effect of successive defoliations upon the vitality of the trees, but such work throughout a large strip of ordinary bush land would be quite out of the question.

We must depend chiefly upon "clean culture" for the control of insect and fungous pests in woodlots. A proper system of handling the trees, by which wounds of all kinds are largely prevented and the trees are given a fair opportunity for healthy growth, would help to reduce the injuries from insects and fungi. Injuries from fire or from falling trees should be carefully avoided. Fire-injured trees are particularly liable to insect attack, and wounds on the trunk and larger branches almost invariably become infected by parasitic fungi, as well as by various insect foes.

Boring-insects of many kinds breed largely in dying and recently dead trees and their parts, and spread from such material to nearby weakened trees and branches, or even attack perfectly sound timber. The dying branches and trees so common in most woodlots are largely caused by boring-insects and rot-causing fungi. The control of such pests consists in removing all injured, dying and dead wood and shelf-fungi during winter and burning it, as firewood or otherwise, before spring opens, so that the contained pests are destroyed before they can spread to the living trees. All slash from cuttings should be burned during winter or early spring. If green slash is left through the spring it serves as a trap for many boring insects, which may then be destroyed by burning the piles towards the end of June, but fire danger, of course, must be considered first. The stumps should be cut low and barked. Logs which must be left in the woods during the months of June and July can be preserved from borers by barking before the last of May. All trees which are badly injured or dying should come out, to give place for others and to remove breeding grounds for insects.

Healthy trees are less subject to attack by most insects and fungi, and conditions which produce a thrifty tree growth aid greatly in preventing such injuries.

VARIATION IN THE COLOUR OF THE BRISTLES OF THE HEDGE-HOG CATERPILLAR, *ISIA ISABELLA* S. and A.

ARTHUR GIBSON, CHIEF ASSISTANT ENTOMOLOGIST, DEPARTMENT OF AGRICULTURE, OTTAWA.

For some years the writer has been interested in the remarkable variation in the colour of the larval bristles of the arctian, *Isia isabella* S. and A., and an endeavour has been made to obtain a series of the mature larvæ in colours, ranging from wholly red to wholly black. This series is not as yet quite complete, but it is, I think, of sufficient interest to present at this meeting. As almost everyone knows, in most specimens the colour of the bristles from the central segments is a rust-red, the remaining bristles being black. For some time I have had specimens in which the red bristles predominated, and one example in which almost all of the bristles were rust-red, but it was not until the spring of 1914 that a larva almost wholly black was obtained. This latter specimen was received from British Columbia, along with examples of the more ordinary type. The larvæ were unusually abundant in that province and attracted considerable attention, owing to their well known habit of wandering about in spring preparatory to pupation.

A study of the colour of the bristles of the specimens shown herewith, indicates as follows:—

Specimen No. 1.—This example has nearly all of the bristles from the tubercles of a bright rust-red, the exceptions being a few black bristles from the lateral tubercles on segments 2, 3 and 4, and a few from dorsal tubercles on segment 2.

Specimen No. 2.—The bristles on this specimen are rust-red from all segments excepting those on segments 4 and 5, and a few from segments 2 and 3, which are black.

Specimen No. 3.—From segments other than 3, 4 and 5, and a few from dorsum of segment 12, the bristles are rust-red.

Specimen No. 4.—The black bristles on this larva are from segments 3 and 4, and on dorsum of segments 12 and 13, and a few from lateral tubercles on anal segment; the others rust-red.

Specimen No. 5.—Bristles black from segments 2, 3, 4, 5, 12, 13 and from tubercle I on segment 6; other bristles rust-red.

Specimen No. 6.—This specimen shows additional black bristles on segment 6, namely, from all the tubercles excepting II.

Specimen No. 7.—Bristles from segments 2, 3, 4 and 5 wholly black, from segment 6 mostly black, few rust-red bristles from tubercles II and III, and about half of this colour from tubercle IV. The bristles on the dorsum of segment 11, from tubercles I, II and III, and all from segments 12 and 13 are also black.

Specimen No. 8.—This larva differs from No. 7 in having all the bristles on segment 6 black, and only rust-red bristles from tubercles VI, VII and VIII on segment 11.

Specimen No. 9.—From all tubercles on segments 2, 3, 4, 5, 6, 12 and 13 the bristles are black; the others rust-red.

Specimen No. 10.—In this larva the black bristles are from the same segments as is the case with No. 9, but in addition all the bristles from tubercle I on segment 7, and from tubercles I, II and III on segment 11 are also black.

Specimen No. 11.—The only rust-red bristles on this specimen are from segments 8 and 9.

Specimen No. 12.—Almost wholly black, only a few very dark reddish-brown bristles from lateral tubercles, particularly on central segments.

HENRY HERBERT LYMAN, M.A.

The appalling calamity that befell the steamship "Empress of Ireland," in the River St. Lawrence, near Father Point, shortly after midnight on Friday, May 29th, was acutely brought home to the older members of the Entomological Society of Ontario by the sad tidings that Mr. H. H. Lyman and his wife were among the thousand and more who were lost. For some few days we hoped against hope, but no traces of them have been found and there is not a vestige to show in what manner death came upon them; it seems most probable that they were drowned in their stateroom before they had time to escape. Mr. Lyman was to have sailed a fortnight earlier, but owing to the pressure of business matters he postponed his departure, with so sad a result.

Mr. Lyman was born in Montreal on the 21st of December, 1854, and received his early education at the High School and West End Academy. At McGill University he took the Arts Course and proceeded to the degree of B.A. in 1876, winning the Logan Medal in Geology and Natural Science, and received his M.A. degree in 1880. On completing his college career he entered his father's firm, Lymans, Clare & Co., wholesale chemists and druggists in Montreal; in 1885 he became a partner in the business, whose name has been changed to Lyman, Sons & Co. On the death of his father he became senior partner and president of Lymans, Limited, which includes the branch house in Toronto. His position in these important concerns manifests his remarkable business capacity and the attention he must have paid to their affairs. The houses are widely known throughout Canada, and bear the highest reputation for upright dealing, energy, and enterprise.

Though much engrossed with the management of a very large business establishment which demanded a close attention to innumerable details, Mr. Lyman found time for an active interest in many other things. In 1877 he joined the 5th Battalion of the Canadian Volunteer Force (now the Royal Scots of Canada) and rose from ensign to major in 1885, retiring with that rank in 1891. He was a life governor of the Montreal General Hospital; treasurer and vice-president of the Graduates Society of McGill University; fellow of the Royal Geographical Society and of the Royal Colonial Institute; one of the organizers of the Imperial Federation League in Canada, and a member of the deputation which waited upon Lord Salisbury's administration in 1886, asking that an Imperial Conference representing the whole British Empire should be summoned; the conference was held during the following year; he was also a director of the British and Colonial Press Service. Though little interested in local politics he was an ardent Imperialist, and considered that the perpetual unity of the Empire far surpassed in importance all other political questions; he advocated Imperial preferential trade and believed that Canada should bear its share of the burden of Imperial defence.

To turn to a different aspect of his life, the one in which our readers are more interested—we learn that when only eight years of age he began to observe insects and their ways, and when a boy of twelve commenced to form a collection of Lepidoptera, which has now become one of the finest and most extensive in Canada. On January 5th, 1875, Mr. Lyman became a member of the Entomological Society of Ontario by joining the Montreal branch. At the following meeting he exhibited a case of butterflies from Illinois, following a custom which has always been characteristic of the Montreal meetings. These exhibits usually led to discussions in which Mr. Lyman took an active part and spared no pains

in arriving at correct conclusions, studying the original descriptions, and at times taking the specimens to the United States or the British Museum for final determination. He would never jump at conclusions, but, sparing no time or trouble, would not rest satisfied till certainty was assured.

His first paper was presented at the meeting on October 5th, 1875, being a description of the larva and pupa of *Grapta interrogationis*; this was followed a few months later by a list of Diurnal Lepidoptera taken at Portland, Maine (published in the Can. Ent. XII., 7-9). For nearly ten years he spent his annual summer holiday on the Atlantic coast, where he added largely to his collections and developed his love for the butterflies, which he took great delight in rearing through all their stages. The first article from Mr. Lyman's pen which appeared in the Canadian Entomologist (Volume VI., page 38) is in the form of a letter asking question about several butterflies found at Portland, Maine. In the same volume (page 158) he described the curiously marked egg of *Gastropacha americana*. From the 19th to the 44th volume, none have been without at least one article from his pen, and he lately expressed his regret that he failed to contribute last year to Vol. XLIV. In addition to his articles in this magazine, he wrote several of a more popular character for the Annual Reports of our society, and contributed a few also to "Entomological News." A list of his more important papers is given below.

The third annual meeting of the Montreal branch was held at Mr. Lyman's residence on May 7th, 1876, at which the minute book records that "he exhibited his fine collection of local and exotic insects." This was the beginning of a long series of gatherings under his hospitable roof; during thirty-seven years a large proportion of the monthly meetings were held there, and were thoroughly enjoyed by the members and occasional visitors from a distance. They were made especially interesting at times by his delightful accounts of visits to scientific gatherings in the United States and Europe as well as in Canada; he would recount the proceedings often with a good deal of humour, and tell of the eminent men whom he met. In the course of years he gathered together a large collection of books on the Lepidoptera of North America chiefly, and these he was always most kind in lending to his fellow members when they required to consult them.

While interested in everything connected with the Lepidoptera of this continent, he paid little attention to the "Micros," but was always keen to acquire specimens for study and comparison of such genera as Colias, Argynnis, Grapta, Chionobas, Haploa, Hyphantria, Papaipema, Xylina and Hepialus. His papers on these subjects will always be found of value and interest.

On June 5th, 1877, he was elected Vice-President of the Montreal branch, and four years later he became President, holding the higher office for two years; in 1888 he again became President, and retained the position till 1899.

In 1895 he was elected Vice-President of the parent society, and in 1897 became President, holding the highest place in the society for the usual term of two years, to the great satisfaction of the members. He rarely missed one of our annual meetings, and as a permanent director of the society took an active part in the management of its affairs. His interests, however, were not confined to his native land. Many years ago he joined the American Association for the Advancement of Science and was recently much gratified at being elected a Fellow: he used to say that an amateur who did good work was really more deserving of honour and recognition than a professional entomologist, who received pay for his work. He was also a Fellow of the Entomological Society of America and of the

Entomological Society of London, England; an honorary member of the New York Entomological Society and the Cambridge Entomological Club; for some time he was Vice-President of the Natural History Society of Montreal. His last official act was the reading of his report as delegate from our society to the Royal Society at the meeting in Montreal on Wednesday, May 27th, the day before he started on his fatal voyage.

For a long time past Mr. Lyman's friends had been much distressed by his increasing deafness, which of late had almost become total. Conversation with him could only be carried on with the aid of an ear-trumpet or by writing. In spite of this severe disability, he was always bright and cheerful, full of innocent fun and enjoying a harmless joke. He travelled about a great deal, attending scientific meetings and other gatherings, among others the International Congresses of Entomology at Brussels and Oxford, which he seemed to enjoy, though latterly he could not hear a word of the papers and discussions. The writer and many friends were greatly pleased as well as surprised when he informed us that he was about to be married. Since the death of his mother, to whom he paid devoted attention during a long period of weakness and infirmity, he had been living a somewhat lonely life. Two years ago, in March, 1912, he was married to the daughter of the Rev. William Kirkby, of New York, formerly rector of Collingwood, Ontario. She attended, with her husband, the Jubilee meeting of our society at Guelph last August, and charmed all who had the pleasure of spending any time in her company. It seems inexpressibly sad that our two friends should have had so short a period of happy married life, and have ended their days together in a tragedy so sudden and so awful.

Mr. Lyman's Published Papers.

To the Canadian Entomologist he contributed sixty articles, among which the following may be mentioned:—

Notes on Colias Christina, Vol. XVI., 5.

The North American Callimorphas, Vols. XIX., 181 with plate, and XXI., 231.

Can Insects Survive Freezing? Vols. XXIV., 1, and XXX., 287.

Pamphila Manitoba and Its Varieties, XXIV., 57.

Prep. Stages of Nemeophila Scudderi, XXV., 248.

Occurrence of Hepialus Thule at Montreal, XXV., 297, and XXXIX., 397.

The Larger Species of Argynnis and the Mystery of Their Life History, XXVIII., 143.

Prep. Stages of Erebia Epipsodea, XXVIII., 274.

Life History of Colias Interior, XXIX., 249.

Life History of Xylina Bethunei, XXXIII., 1.

What is a Genus? XXXIV., 187.

New Gortynas, XXXVII., 305 (with plate).

A North American Entomologists' Union, XXXVIII., 1.

Type and Typical, XL., 141.

Recent Work Among the Borers, XL., 249.

Notes on N. A. Graptas in the British Museum, XLIII., 418.

The second International Congress of Entomology, XLIV., 370.

In the Annual Reports:

No. 23, p. 32, A Trip to Mt. Washington.

No. 32, p. 57, Fall Web-worms, with plate of 33 figures.
No. 32, p. 61, Notes on Danais Archippus.
No. 37, p. 39, A Hunt for a Borer.
No. 39, p. 145 Life History of Euchetias Oregonensis.
No. 40, p. 46, Origin and Diffusion of Entomological Errors .

In 29th Report, p. 17, President's Annual Address, delivered on the occasion of the 25th anniversary of the Montreal Branch.

In Entomological News, Vol. XVIII., p. 420, is an able article on *Thecla calanus* and *T. edwardsii* (with the footnote that it was read before the Ent. Soc. of Ontario at Guelph, July 4, 1907).

In Vol. VII., 172, On Occurrence of *Chionobas tarpeia* in North America.

Several short items also appear, including one regarding *Erebia discoidalis* in the first volume, p. 146.

C. J. S. B.

DR. WILLIAM SAUNDERS, C.M.G.

On Sunday afternoon, September 13th, after an illness which had continued for nearly two years, and which for a twelvemonth had rendered him mentally incapable, Dr. William Saunders passed to his rest at his home in London, Ontario, in the seventy-ninth year of his age. He was born in Devonshire, England, and came to Canada with his parents when a boy of twelve. His educational advantages were meagre, but he succeeded in obtaining a technical training in chemistry and set up in business as a retail druggist in London. His agreeable manners, thorough honesty, and untiring industry brought him a fair measure of success. His love of nature led him to the collection of wild plants and insects, which could be found in abundance in the neighbourhood, and he became an ardent student of botany and entomology. Finding many medicinal plants readily obtainable, he began the preparation of fluid extracts, which were so pure and reliable that they soon became widely and favourably known among the medical profession, and led by degrees to the establishment of an extensive and lucrative business, both wholesale and retail. Years later, when he became Director of the Experimental Farms of the Dominion, the wholesale business was transferred to his eldest son, Mr. W. E. Saunders, by whom it is still successfully maintained, and the retail department to two of his younger sons, who, however, afterwards relinquished it for other pursuits.

During the five-and-twenty years of his business life, Mr. Saunders found time for taking an active part in many other things. Besides his scientific work in entomology and botany, he took a great interest in fruit-growing, establishing a farm of his own near the city, and becoming a zealous member of the Ontario Fruit Growers' Association, of which he was a director for many years and president from 1882 to 1885. In connection with his professional work he was appointed Professor of Materia Medica in the Western University, Public Analyst for Western Ontario, and President for two years of the Ontario College of Pharmacy, of which he was one of the founders. He was an active member of the American Pharmaceutical Society, and Fellow of the American Association for the Advancement of Science. His attendance at the meetings of these societies, held from year to year in various cities of North America, caused him to have a widely extended friendship with notable men of all kinds, by whom he was highly esteemed and respected.

The writer's acquaintance with Dr. Saunders began more than fifty years ago when we were both young men, and soon ripened into a warm friendsip, which has continued unbroken until now during all these years. In those early days, when the study of entomology was so difficult owing to the scarcity of books on the subject, we were in constant correspondence, helping each other in every way we could, and spending each summer some days together, comparing notes, studying specimens and making collecting expeditions. Many happy hours we spent together in early morning tramps to the ponds and woods about London, and in the evening, when his day's business was over, in examining the captures we had made. At that time there were few in Canada who took the least interest in the objects which to us afforded the keenest pleasure, but as time went on we found here and there a congenial spirit, and were led on in 1862 to attempt the organization of an Entomological Society. This was successfully accomplished during the following spring, and last year the completion of half a century's work and progress was celebrated by the jubilee meeting at Guelph. An account of the proceedings on that occasion and the history of the formation and growth of the society have been given in the November (1913) number of the "Canadian Entomologist" and the 44th Annual Report of the Society. In 1868 Mr. Saunders and the writer decided upon making another venture and began the publication of the "'Canadian Entomologist," to the first two numbers of which we were the sole contributors. For five years the latter was the editor, and was then succeeded by Mr. Saunders, who continued the management of the magazine until his removal to Ottawa in 1886. Three years previously there was published in Philadelphia his notable book "Insects Injurious to Fruits," which is justly regarded as a classic by economic entomologists. A second edition was issued in 1892, and the author had begun the preparation of a third when his prolonged illness rendered him incapable of accomplishing any literary work. A list of his published articles, bulletins, reports, etc., fills six columns of the Bibliography in the Transactions of the Royal Society of Canada for 1894, and a large number have been added since. In 1881 he had been appointed by the Governor-General of Canada, the Marquis of Lorne, one of the original Fellows of the Royal Society, and in 1906 he was elected President, having thus risen to the highest position of honour for scientific work that can be attained in this Dominion. Twenty years ago it was said of him by an American writer that "by painstaking study and observation he had risen to the topmost pinnacle of fame as an entomologist, horticulturist and experimental agriculturist."

A very important change took place in the life and work of Dr. Saunders in 1886, when he was appointed Director of the Experimental Farms of the Dominion, and left his home and business in London to reside in Ottawa. During the previous year he was commissioned by the Government to visit various Experimental Stations in the United States and to report upon agricultural and experimental work in Europe and America. In this new sphere of labour he applied himself with his wonted vigour, and in the course of a few years was mainly instrumental in bringing these establishments into thorough working order and into a high standard of excellence. Anyone who saw the Ottawa Farm in the autumn of 1866—a large tract of bare land, with workmen busily employed in levelling and removing stumps and boulders with dynamite—and then visited it ten or fifteen years later (as did the writer) could not fail to be impressed with the wonderful work accomplished by the genius of Dr. Saunders in turning a waste into a scene of beauty and a hive of industry. Here have been carried on under his direction a great variety of experiments in breeding and feeding live stock, testing soils and

water, growing fruit and ornamental trees of all kinds, selecting hardy varieties, improving the size and quality of any fruits suited to the climate of the Western Provinces, beekeeping, experiments and observations in economic entomology, plant pathology, and various other matters pertaining to the welfare and benefit of the farming community. Especially noteworthy was his work in crossing varieties of grain and producing new and improved kinds; one alone of these, the Marquis wheat, is believed to have added millions of dollars to the value of the wheat products of the prairie country. All information thus acquired has been freely afforded to the farmers by distribution of seed, and bulletins and reports on all manner of subjects.

The ever-growing work and its extension in every Province of the Dominion began at length to tell upon the physical strength of the man who was the mainspring of it all. His vitality, owing to advancing years and the inroads of an insidious disease, began to fail, and he felt that the time had come for his retirement. Accordingly he resigned about three years ago, and went with his wife and daughter for a pleasure trip to Europe—his first real holiday since he went to Ottawa. His friends expected him to return with much improved health, but it was ordered otherwise; he became very ill in England, and never entirely recovered. He had completed his life work, his duty was well done, and he has left the record of great deeds accomplished, and of vast and widespread benefits conferred upon the people of the land. This account of a remarkable man would be incomplete without a reference to his beloved wife, who was a true helpmeet both in small things and in great. Ever cheerful and encouraging, full of kindness and hospitality, perfectly unassuming and free from all affectation, she is loved and esteemed by all who know her, and her children and friends rise up and call her blessed. To her, in her desolation, and to her family in their sense of loss our sympathies go out in the fullest measure.

The ability and work of Dr. Saunders have been recognized in many gratifying ways. In 1905 he received the distinction of Companion of the Order of St. Michael and St. George, conferred by His Majesty King Edward; Honorary LL.D. from Queen's University in 1896, and from the University of Toronto in 1903; the Mantua Gold Medal for distinction in scientific knowledge. He was a fellow of the Entomological Society of London and the Royal Microscopical Society; an honorary member of the Pharmaceutical Society of Great Britain and of the Highland and Agricultural Society of Scotland, and an ordinary member of a large number of scientific societies in the United States of America.

C. J. S. B.

THE ENTOMOLOGICAL RECORD, 1914.

Arthur Gibson, Chief Assistant Entomologist, Department of Agriculture, Ottawa.

Every year new names of persons residing in various parts of Canada are added to the list of those who collect insects, and owing to the increased interest which is taken in the collection and study of insects, it seems desirable to again point out the chief reasons for the publication of this annual Entomological Record. As stated in an early issue of the Record, there is no object in publishing year after year long lists of insects which have been taken within their

known range, but only such data as it is thought will be of value to students of geographical entomology, and to those interested in life-histories, particularly the exact dates when the various insects occur in the perfect state. Notes on species not known to have been previously recorded from any of the provinces are specially desired. Where districts within any of the provinces have been fairly well worked over, any new additions to such local lists would be of value. Such information we have endeavoured to present from year to year, in addition to brief references to literature of interest to Canadian students.

During 1914, many interesting species were collected throughout Canada, and in the determination of certain of these and of specimens gathered in former years we have again received much help from the recognized authorities in the United States and elsewhere. Our special thanks are due to Dr. L. O. Howard and his associates at Washington—Dr. Dyar, Dr. Banks, Messrs. Schwarz, Crawford, Busck, Rohwer and Knab; Sir George F. Hampson, of the British Museum; Prof. H. F. Wickham, of Iowa City, Iowa; Mr. E. P. Van Duzee, of Department of Agriculture, University of California, Berkeley, Cal.; Dr. Henry Skinner, of Philadelphia, Pa.; Col. Thos. L. Casey, of Washington, D.C.; Mr. C. W. Johnson, of Boston, Mass.; Mr. Chas. Liebeck, of Philadelphia, Pa.; Prof. H. S. Hine, of Columbus, Ohio; Mr. Chas. W. Leng, of New York, N.Y.; Prof. J. M. Aldrich, La Fayette, Ind.; Dr. W. G. Dietz, of Hazleton, Pa.; Mr. J. R. de la Torre Bueno, of White Plains, N.Y.; Mr. F. H. Wolley-Dod, of Midnapore, Alta., and Dr. E. M. Walker, of Toronto, Ont.

Literature.

Casey, Thos. L. Memoirs on the Coleoptera, V; published by the New Era Printing Company, Lancaster, Pa.; issued Nov. 28, 1914, pp. 387. This fifth memoir consists of: Part I, Studies in Omus and Cicindela, pp. 1-24; Part II, Some observations on the Carabidæ, including a new subfamily, pp. 25 to 44; Part III, A Revision of the Nearctic Harpalinæ, pp. 45-305; Part IV, A Review of the Genus Thyce and of the North American species of Polyphylla, pp. 306-354; Part IV, Miscellaneous Notes and New Species, pp. 355 to 376. In the memoir 333 species are described as new, seven of which are from Canada.

Crawford, David L. A contribution toward a monograph of the Homopterous insects of the Family Delphacidæ of North and South America; Proc. U. S. N. M., Vol. 46, pp. 557-640, with plates 44-49; published March 4, 1914, received 11 March. In this paper 35 species are described as new, and nine as new varieties. None of these are from Canada. Five species are recorded from the Dominion. The author states that the family Delphacidæ was until quite recently, in fact, by some, is still, considered as a subfamily of the larger group Fulgoridæ. By most students now, however, it is separated from its near relatives as a distinct family, chiefly on account of the large movable spur, or calcar, at the base of the posterior tibiæ.

Crawford, David L. A monograph of the Jumping Plant-lice or Psyllidæ of the New World, Bulletin 85, U. S. N. M., Washington, D.C., issued June 3, 1914, pp. 186, plates 30. In this important contribution, 68 species are described as new or new varieties, four of which are from Canada. In addition to these latter, Canadian records are given of 10 other species. Pages 5 to 16 are devoted to a discussion of the head, the thorax, appendages of the thorax and abdomen. Brief chapters on Locomotion, Relations to other Homoptera, Collecting and Preserving and Determinations from Immature Stages will be found

on pages 16 and 17. Then follows a systematic discussion of the species. As the title would indicate only American genera are treated in the monograph. These have been arranged in six subfamilies—Liviinæ, Pauropsyllinæ, Carsidarinæ, Ceriacreminæ, Triozinæ and Psyllinæ.

HAMPSON, SIR GEORGE F. (Bart.) Catalogue of the Lepidoptera Phalænæ in the British Museum, Vol. XIII, Noctuidæ, Sept. 1913, 609 pp. plates CCXXII-CCXXXIX; received 12 Jan., 1914. The subject of this volume is the classification of the remainder of the noctuid subfamily Catocalinæ and the subfamilies Mominæ and Phytometrinæ. The Catocalinæ are represented in the volume by 44 genera and 379 species, making a total of 107 genera and 1,022 species for the subfamily. The Mominæ are represented by 11 genera and 74 species and the Phytometrinæ by 15 genera and 226 species. Records are given of 197 species from North America, six of which are described as new. 67 Canadian locality records are included. An interesting portion of the volume is the treatment of the species known under the old name of *Plusia*, also the arrangement of the species in the genus *Zale*. The excellent plates which accompany the volume are indeed beautiful and of great value.

HEWITT, C. GORDON. The House-fly, Its Structures, Habits, Development, Relation to Disease and Control; Cambridge; at the University Press, 1914; 382 pages, 3 full page coloured plates, and 104 text figures; price 15 shillings net. This is undoubtedly the most comprehensive and complete volume which has yet appeared on the house-fly. It has been prepared primarily for the use of entomologists, medical men and health officers. It is divided into six parts, viz.: Part I, The Structure and Habits of the House-fly; Part II, The Breeding Habits, Life-history and Structure of the Larva; Part III, The Natural Enemies and Parasites of the House-fly; Part IV, Other Species of Flies Frequenting Houses; Part V, The Relation of House-flies to Disease; Part VI, Control Measures.

HEWITT, C. GORDON. Bibliography of Canadian Entomology for 1912: Ottawa; Trans. Royal Soc. of Canada, Third Series—1913, Vol. VII, Section IV. References are given to 121 papers, 22 of these relate to Lepidoptera, 17 to Hymenoptera, 11 to Diptera, etc., etc. Titles of 48 papers on subjects of economic entomology are given. This annual publication indicates concisely the increasing interest which is being taken in Canadian insects.

MALLOCH, J. R. American Black Flies or Buffalo Gnats: U.S. Dept. Agriculture, Bureau of Entomology, Technical Series No. 26; pp. 70, plates 6; issued April 6, 1914. In this paper 15 species are described as new, three of which are from Canada. On pages 68 and 69 is given a catalogue of North and Central American Simuliidæ. Under the genus *Prosimulium*, 5 species are given; under the genus *Parasimulium*, 1 species, and under the genus *Simulium* 37 species. Of the 38 species the types of 22 are in the United States National Museum.

MORLEY, CLAUDE. A Revision of the Ichneumonidæ based on the collection in the British Museum (Natural History), Parts III, Tribes Pimplides and Bassides: British Museum (Natural History) 1914, pp. 148, 1 plate (coloured); received Sept. 1, 1914. Part I appeared in 1912 and Part II in 1913. In Part III, 374 species are included, 49 of which are described as new. Records are given of 15 species from Canada, which are in the British Museum; 2 of these are described as new.

SKINNER, HENRY. Studies in the Genus Thanaos: Trans. Amer. Ent. Soc. XL, pp. 195-221, Aug. 3, 1914. This paper is of much interest. These butterflies have always troubled lepidopterists, but thanks to Dr. Skinner we are now able

to understand them much better. Definite records from Canada are given of five species. Two species are described as new.

SLINGERLAND, THE LATE MARK VERNON, and CROSBY, CYRUS RICHARD, Manual of Fruit Insects: New York; The Macmillan Company, 1914; pp. 503; 396 illustrations; price $2.00. This much needed book was published in July, 1914, and is an excellent work of reference. Although prepared specially for fruit growers, entomologists generally will find this volume of extreme use. It is divided into 15 chapters, the titles of which are: I, General Considerations; II, Apple Insects—The Fruit; III, Apple Insects—Buds and Foliage; IV, Apple Insects—Aphis, Scales and Others; V, Apple Insects—Borers and Miscellaneous; VI, Pear and Quince Insects; VII, Plum Insects; VIII, Peach Insects; IX, Cherry Insects; X, Raspberry, Blackberry and Dewberry Insects; XI, Currant and Gooseberry Insects; XII, Strawberry Insects; XIII, Grape Insects; XIV, Cranberry Insects; XV, Insecticides. In the appearance of this book the science of entomology in Canada is indeed honoured. The following words appear on the dedication page: "To William Saunders, Leader in Agricultural Enquiry, author of 'Insects Injurious to Fruits,' which for nearly one-third of a century has been the standard work on the subject, this book is dedicated as a token of appreciation."

SOMES, M. P. The Acridiidæ of Minnesota. University of Minnesota Agricultural Experiment Station, Technical Bulletin No. 141, University Farm, St. Paul, July, 1914; pp. 100, plates 4 (3 coloured). In this very useful systematic study the author states, every effort has been made to furnish data which shall apply to the forms found in Minnesota and the tables and descriptions have been rewritten and modified to fit them to local conditions. Notwithstanding, this bulletin will be found of much value to Canadian students of orthoptera. In addition to the descriptive notes, much information is given under many of the species, on habitat, flight, etc. The plates at the end of the bulletin are, in general, excellent.

VIERECK, HENRY L. Type species of the Genera of Ichneumon Flies; Bulletin 83, United States National Museum, Washington, D.C., issued Jan 31, 1914; pp. 186; received Feb. 13. This paper, as the author states, is an alphabetic catalogue of the genera of the Ichneumonoidea, together with the type of each genus. It is presumed to be complete up to the end of 1912. It is a most useful contribution and will be welcomed by students of hymenoptera.

The following is a list of the names and addresses of collectors heard from during 1914:

Anderson, E. M., Provincial Museum, Victoria, B.C.
Baird, Thos., High River, Alta.
Beaulieu, G., Ent. Branch, Dept. Agr., Ottawa.
Beaulne, J. I., Ent. Branch, Dept. Agr., Ottawa.
Bethune, Rev. Prof., O.A.C., Guelph.
Blackmore, E. H., Victoria, B.C.
Brimley, J. F., Wellington, Ont.
Brittain, W., Agric. College, Truro, N.S.
Bush, A. H., 1105 Broadway, Vancouver, B.C.
Caesar, L., O.A.C., Guelph, Ont.
Chagnon, Gus., Box 521, Montreal.

Chagnon, W., St. John's, Que.
Chandler, Frank S., Kaslo, B.C.
Chrystal, R. N., Ent. Branch, Dept. Agr., Ottawa.
Cockle, J. W., Kaslo, B.C.
Cosens, Dr. A., Parkdale Collegiate Institute, Toronto.
Crew, R. J., 561 Carlaw Ave., Toronto.
Criddle, Evelyn, Aweme, Man.
Criddle, Norman, Aweme, Man.
Dawson, Horace, Hymers, Ont.
Day, G. O. Duncans, B.C.
Dod, F. H. Wolley-, Midnapore, Alta.
Emile, Rev. Bro., Longueuil, Que.
Evans, J. D., Trenton, Ont.
Fyles, Rev. Dr. T. W., 368 Frank St., Ottawa.
Germain, Rev. Bro., 125 Empress St., Ottawa.
Gibson, Arthur, Ent. Branch, Dept. Agric., Ottawa.
Hahn, Paul, 433 Indian Road, Toronto.
Haight, D. H., Sudbury, Ont.
Hanham, A. W., Duncan, B.C.
Harrington, W. H., P. O. Dept., Ottawa.
Hewitt, Dr. C. Gordon, Ent. Branch, Dept. Agric., Ottawa.
Hudson, A. F., Millarville, Alta.
Hudson, H. F., Strathroy, Ont.
Johnson, Geo. S., Moose Jaw, Sask.
Kitto, V., Inland Revenue, Dept. Interior, Ottawa.
Leavitt, A. G., St. John, N.B.
McIntosh, W., St. John, N.B.
Mignault, Rev. J. B., Ste. Therese, Que.
Moore, G. A., 850 St. Hubert St., Montreal.
Nicholls, Arch., Saulte Ste. Marie, Ont.
Perrin, Jos., McNab's Island, Halifax, N.S.
Petch, C. E., Covey Hill, Que.
Ruhmann, Max H., Vernon, B.C.
Ross, W. A., Vineland Station, Ont.
Sanders, G. E., Bridgetown, N.S.
Sanson, N. B., Banff, Alta.
Simpson, W., Dominion Observatory, Ottawa.
Simms, H. M., 192 Ontario East, Montreal.
Sladen, F. W. L., Experimental Farm, Ottawa.
Stewart, G. M., 83 Smith St., Winnipeg, Man.
Strickland, E. H., Experimental Station, Lethbridge, Alta.
Swaine, J. M., Ent. Branch, Dept. Agric., Ottawa.
Tams, W. H. T., Midnapore, Alta.
Taverner, P. A., Victoria Memorial Museum, Ottawa.
Tothill, J. D., Fredericton, N.B.
Treherne, R. C., Agassiz, B.C.
Venables, E. P., Vernon, B.C.
Walker, Dr. E. M., Univ. of Toronto, Toronto.
Wallis, J. B., Machray School, Winnipeg, Man.
Whitehouse, F. C., Red Deer, Alta.

Willing, Prof. T. N., Univ. of Saskatchewan, Saskatoon, Sask.
Wilson, Tom, 1105 Broadway, Vancouver, B.C.
Winn, A. F., 32 Springfield Ave., Westmount, Que.
Young, C. H., Victoria Memorial Museum, Ottawa.

NOTES OF CAPTURES.

(Species preceded by an asterisk (*) described during 1914.)

LEPIDOPTERA.

(Arranged according to Dyar's List of North American Lepidoptera. U.S. Nat. Museum Bull. No. 52.)

(Dyar's number.)

Pieridæ.

40. *Pontia rapæ* var. *novangliæ* Scudd. Smith's Cove, N.S., Aug. 11 (Gibson).
52. *Callidryas eubule* L. Mr. W. E. Saunders, of London, Ont., reports having seen three specimens of this southern butterfly on Oct. 4 and 5. One of the specimens settled within three or four feet of him and spread its wings, so that he had an excellent view of it.
81. *Pyrisita mexicana* Bdv. Aweme, Man., Oct. 1, (N. Criddle); Sept. 27, (E. Criddle). Another very interesting record.

Nymphalidæ.

222. *Vanessa carye* Hbn. Not uncommon this season, Duncan, B.C., noticed ovipositing on hollyhocks, not observed in the district before, (Hanham). Mr. R. N. Chrystal found the larvæ, the past season, doing considerable damage to hollyhocks, at Vancouver, B.C.

Hesperiidæ.

487. *Erynnis comma* var. *laurentina* Lyman. Bonaventure Island, Que., Sept. 20, (Taverner and Young). In Dr. Skinner's Synonymic Catalogue of the N. A. Rhopalocera (1898) the reference should be corrected to read "Can. Ent., XXIV, 59, 1892. The same correction should be made in Dyar's catalogue.

Sphingidæ.

Hemaris diffinis var. *ariadne* B. and McD. (Psyche, XVII, 202, 1910). Midnapore, Alta.; common at dandelion blossoms, May 29, 30, (Tams). This is the *diffinis* of my Alberta list and the form figured by Holland as *thetis*, on Pl. 11, fig. 1, (Dod).

653c. *Hemaris diffinis* var. *rubens* Hy. Edw. Midnapore, Alta., a male, June 18, (Tams). New to Alberta. Exactly like Vancouver Island specimens, which, according to Barnes and McDunnough, are typical *rubens* or as it is listed by them. "*diffinis-thetis* var. *rubens*." It appears to me distinct from *ariadne* (Dod).

656. *H. thysbe* Fabr. var. *cimbiciformis* Steph. Several at Edmonton, Alta. May 10-16, by Mr. Val. Fernekes; the same form as that entered by me as *ruficaudis* in the Record of 1910, but Barnes and McDunnough state that the latter name is a pure synonym of *thysbe,* which has dentate margins as per Holland's figure, whilst *cimbiciformis* has margins even, (Dod).

657. *Lepisesia flavofasciata* Walk. Midnapore, Alta., May 21st, one female (A. F. Hudson). Several seen flying in sunshine at the Billing's Mill locality, on May 31st. (Hudson and Tams.) Only one previous Alberta record, (Dod).

677. *Pholus fasciatus* Sulz. Granville Ferry, N.S., Aug. 19, 1910, (Payne).

704. *Sphinx luscitiosa* Clem. Edmonton, Alta., May 10-16. A female. (V. Fernekes. The second Alberta record, (Dod).

Arctiidæ.

853. *Estigmene prima* Slosson. Moose Jaw, Sask., June, (Johnson).

872. *Hyphoraia parthenos* Harr. Midnapore, Alta., May 16-18. A few flying in sunshine, and at light. (Tams and Dod).

876. *Apantesis michabo* Grt. Moose Jaw, Sask., Sept., 1913, (Johnson).

Noctuidæ.

1029. *Apatela sperata* Grt. Midnapore, Alta., June 15. New to Alberta, (Dod).

1040. *Apatela illita* Sm. High River, Alta., June 19, (Baird).

1047. *Apharetra pyralis* Sm. Banff, Alta., (Sanson).

1050. *Merolonche lupini* Grt. Banff, Alta., June 25-July 12, three specimens, (Sanson). The specimens are a deeper blue-grey and more hoary than typical *lupini,* with less distinct maculation, and fit Smith and Dyar's description of *ursina* about equally well. But I am not at all convinced that these names really refer to distinct species, (Dod).

(1145). *Hillia vigilans* Grt. Midnapore, Alta., Aug. 26, (Dod).

1216. *Hadena contradicta* Sm. Midnapore, Alta., June 30th, a female, at treacle, (Hudson and Tams).

1247. *Hadena cinefacta* Grt. Midnapore, Alta., June 29th, at treacle, (Dod).

Fishia derelicta Hamps. (Ann. and Mag. N. H., Ser. 8, Vol. XII, Dec., 1913). Midnapore, Alta., Sept. 24th, a female at light. Not seen for years, (Dod). Banff, Oct. 2nd, 1913, (Sanson). This is the number 277 of the Alberta List. Sir George Hampson's type is from Aweme, Man., and Calgary and Cartwright specimens are included in the type material, (Dod).

1286. *Momophana comstocki* Grt. Edmonton. Alta., May 13th. A fine male on electric light pole. (V. Fernekes). Agrees well with Hampson's woodcut and description, and with my notes on the type from New York in the British Museum. It appears to be very rare. The species which for many years passed as *comstocki* in Vancouver Island collections is *Feralia columbiana* Smith, (Dod).

Feralia columbiana Sm. Quamichan Lake, B.C., March 29, first specimen I have taken, (Hanham).

1338. *Oncocnemis chandleri* Grt. Midnapore, Alta., Aug. 29, at light. (Tams). The third taken in Alberta, (Dod).

Oncocnemis poliochroa Hamps. (Cat. Lep. Phal. VI, p. 175, 1906.) Midnapore, Alta., Aug. 12-26, a few at light, (Tams). Not taken previously

for several years. It was entered as *chandleri* in my Alberta List (No. 185), and so passed in other western collections until Sir George Hampson recognized it as distinct and named it, (Dod).

1402. *Rhynchagrotis inelegans* Sm. Shawnigan, B.C., July 9, 1912, (Wallis). New to Canada, (Dod).

Noctua acarnea Sm. (Journ. N. Y. Ent. Soc. XIII, 194, Dec., 1905). Banff, July 2, 4, 10, on electric light poles, 3 males in good condition, (Sanson). Described from a male from Banff taken on July 11th, 1902, also by Mr. Sanson. This year's captures are the only specimens I ever saw besides the type, (Dod).

1492. *Noctua patefacta* Sm. Midnapore, Alta., July 11-20. A few at light, (Tams).

1497. *Noctua clemens* Sm. Midnapore, Alta., June 29. A male at treacle. Very rare in Canada, (Dod).

Noctua dislocata Sm. (Can. Ent., XXXVI, 149, June, 1904. Midnapore, Alta., July 2; two at treacle (Dod & Tams).

1547. *Feltia vancouverensis* Grt. Midnapore, Alta., June 2 and 30. A pair, at light, (Tams). I had only one previous Alberta record, June 9th, 1897. The male recently taken scarcely differs from Vancouver Island specimens, (Dod).

Chorizagrotis sordida Sm. (Journ. N.Y. Ent. Soc. XVI, 86, June, 1908). Midnapore, Alta., a rather worn female at light. Aug. 26, (Tams). This is the No. 225 of my Alberta list, which on the strength of a specimen compared with type I now believe to be *sordida*, (Dod).

1583. *Paragrotis dargo* Strk. Moose Jaw, Sask., (Johnson). *Rumatana* Sm. is an exact synonym, (Dod).

1611. *Paragrotis acornis* Sm. Midnapore, Alta., a few at light, Aug. 26th to Sept. 25th, (Tams).

1659. *Paragrotis brunneigera* Grt. Victoria, B.C., (Blackmore). I had formerly given this name to a different species in British Columbia, but the determination is correct, (Dod).

1660. *Paragrotis incallida* Sm. Midnapore, Alta. Two at light, Aug. 6th and Sept. 25th, (Tams).

1725. *Paragrotis infusa* Sm. Lethbridge, Alta., Aug. 23, 1912, (Wallis). Second Alberta record, (Dod).

Mamestra carbonifera Hamps. Banff, Alta., July 1st, 13th. Two males, (Sanson).

1795. *Mamestra nevadae* Grt. Midnapore, Alta., June 16-30. A few at treacle, (Dod & Tams). High River, Alta., June 19, (Baird).

1799. *Mamestra invalida* Sm. Midnapore, Alta., June 29 and July 1. Two females at treacle, (Dod). Banff, Alta., several at light, (Sanson). I now believe this to be identical with *cristifera* Walk., which however is quite distinct from *lubens* Grt., (Dod).

Mamestra lubens Grt. High River, Alta., June 16th, (Baird). Mr. Baird has previously taken the species at High River, though, this is the first published record for Alberta. It is distinct from *cristifera*, (Dod).

1806. *Mamestra rubefacta* Morr. Midnapore, Alta., June 5 and 19. Two fine females at treacle. A great rarity here, (Dod). Hugh River, Alta., June 19, (Baird).

1840. *Mamestra sutrina* Grt. Midnapore, Alta., June 2-18. A few at light, (Tams). Banff, Alta., (Sanson).

1874. *Mamestra tacoma* Strk. Quamichan Lake, B.C., May 22, (Hanham). Recorded in B.C. list only from Kaslo.

1918. *Scotogramma conjugata* Sm. Banff, Alta., July 3, (Sanson).

1930. *Anarta cordigera* Thunb. Midnapore, Alta., May 16-24. A few in sunshine at flowers of bear-berry (*Arctostaphylos uva-ursi*), (Hudson & Tams). New to the district, (Dod).

1937. *Anarta secedens* Walk. Banff, Alta., July 3 and 4, at light, (Sanson).

Heliophila amygdalina Harvey. Winnipeg, Man., June 10, 1910, (Wallis).

2015. *Graphiphora oviduca* Gn. Midnapore, Alta., June 2, at light, (Tams). New to Alberta, (Dod).

2048. *Stretchia plusiaeformis* Hy. Edw. Midnapore, Alta., April 25th, May 17th. A few at light and sallow blossoms, (Dod & Tams). The first seen for years, (Dod).

2102. *Xylina georgii* Grt. Midnapore, Alta., rare, April 30, at treacle, Sept. 21-24, at light and treacle, (Dod & Tams). The species was redescribed by Smith as *holocinerea, ancilla, fletcheri and vertina. Oregonensis* Harvey is apparently also the same species, (Dod).

2111. *Xylina thaxteri* Grt. Quamichan Lake, B.C., May 12; first I have taken in the west, (Hanham).

2146. *Asterocarpus borealis* Sm. Red Deer Alta., about April 24, at rest freshly emerged, (Whitehouse). New to Alberta, and an extremely rare species. The type came from Cartwright, Man. There is a specimen in the British Museum supposed to have come from Luzerne Co., Pa., but its authenticity may be called in question, (Dod).

(2168) *Gortyna pallescens* Sm. Midnapore, Alta., Aug. 26-Sept. 10, a few at light, (Tams). It is not certain whether this form is really distant from *medialis,* (Dod).

2190-1. *Papaipema insulidens* Bird. Quamichan Lake, B.C., Sept. 15, not previously taken, (Hanham).

* *Papaipema lysimachiae* Bird. Montreal and north shore of Lake Erie, Can. Can. Ent. XLVI, 71.

2197. *Pyrrhia umbra* Hfr. Quamichan Lake, B.C., July 29; first I have taken in the West, (Hanham). In the B.C. list recorded only from Kaslo.

2262. *Ipimorpha subvexa* Grt. Moose Jaw, Sask. One specimen bred from a larva found spun between two poplar leaves, (Johnson). The larvæ are stated to have been abundant. The form occurs in Texas and Colorado, and has not previously been recorded from Canada, though it is very close to *nanaimo* Barnes. Grote in his 1895 list expressed a doubt as to its distinctness from *pleonectusa,* which is not unwarranted, (Dod).

Dysocnemis borealis Hamps. Midnapore, Alta., May 8-24, at bear-berry, and sallow blossoms in sunshine. Not rare, (Tams & Hudson). Only four or five specimens previously taken here. The type came from St. Martin's Falls, Albany River. The species has been taken at Cranbrook, B.C., by Mr. C. Garrett, (Dod).

2491. *Autographa flagellum* Wlk. Granville Ferry, N.S., July 25, 1912, (Payne).

2494. *Autographa rubidus* Ottol. Midnapore, Alta., June 2-14, at light, (Tams).

2501. *Autographa alias* Ottol. Midnapore, Alta., Aug. 27; one at light, very rare here, (Dod).

2515. *Autographa epigea* Grt. Midnapore, Alta., Aug. 15, at light, (Tams).
Autographa orophila Hamps. Moraine Lake, near Laggan, Alta., (Whitehouse).

2555. *Alabama argillacea* Hbn. Aweme, Man., Oct. 7, (Criddle); Winnipeg, Man., (Wallis).

2846. *Catocala pura* Hulst. Red Deer, Alta., about Sept. 1, (Whitehouse). The specimen is of a species new to Alberta, and I record it as *pura* solely on the strength of Holland's figure. Heath recorded it from Cartwright, Man., in the Record for 1907, (Dod)

2864. *Catocala ultronia* Hbn. Husavick, Man., Aug. 8, 1913, (Coates).

2872. *Catocala cerogama* Gn. Miami, Man., July 29, (Wallis); Husavick, Man., July 28, (Coates).

2890. *Catocala whitneyi* Dodge. Miami, Man., July 28, (Wallis).

3006. *Erebus odora* L. Mr. W. McIntosh informs me that two specimens of this southern noctuid were taken at St. John, N.B., during 1914, one about five miles from the city, at the end of August, by Mr. W. S. Nelson; the other specimen was collected by Mr. John McCarthy.

Pericopidæ.

3087b. *Gnophela vermiculata* G. & R. Billing's Mill, near Millarville, Alta., July 26, flying in sunshine, (Hudson).

Notodontidæ.

3117. *Notodonta simplaria* Graef. Midnapore, Alta., June 6-30, at light, (Tams). One on fence-post, (Dod).

3151. *Schizura unicornis* S. & A. Midnapore, Alta., one at light, (Tams).

3169. *Gluphisia lintneri* Grt. Midnapore, Alta., April 19-May 1. Several at light, (Tams).

Thyatiridæ.

3177. *Pseudothyatira expultrix* Grt. Midnapore, Alta., June 30, at treacle, (Tams); High River, Alta., June 16, (Baird).

3180. *Euthyatira pudens* Gn. Midnapore, Alta., June 13, at light, (Dod), and 17th, at treacle, (Tams); new to Alberta, (Dod).

3184. *Bombycia tearlii* Hy. Edw. Midnapore, Alta., Aug. 26, at treacle, (Tams).
Bombycia fasciata B & McD. Kaslo, B.C., (Cockle).

Lasiocampidæ.

3223. *Epicnaptera americana* Harr. Midnapore, Alta., May 1-June 2, at light, (Tams).

Geometridæ.

3233. *Nyctobia viridata* Pack. Edmonton, Alta., May 10-16, (Fernekes). New to Albert, (Dod).

3236. *Nyctobia nigroangulata* Strk. Edmonton, Alta., May 10-16, (Fernekes). New to Alberta. Mr. Swett tells me that this is probably a western race of *limitaria*, Walk., (Dod).

3237. *Cladora atrolituata* Walk. Edmonton, Alta., May 10-16, (Fernekes). New to Alberta, (Dod).

Eupithecia adornata Taylor. Midnapore, Alta., May 1-June 3. A few at light, (Tams). I cannot separate this species from a specimen named *nimbicolor* Hulst for me by Taylor, (Dod).

3330. *Venusia duodecemlineata* Pack. Edmonton, Alta., May 10-16, (Fernekes). New to Alberta, (Dod).

3337. *Epirrita dilutata* D. & S. Midnapore, Alta., Sept. 7, found drowned in a water barrel. Mr. Swett considers this specimen to be a dark variety of this species, though it differs considerably from any British series. New to Alberta, (Dod).

3391. *Hydriomena californiata* Pack. Midnapore, Alta., June 5, 9; the first published record for Alberta, though a few specimens have been taken previously, (Dod).

3605. *Orthofidonia exornata* Walk. Edmonton, Alta., May 10-16, (Fernekes). New to Alberta, (Dod).

3784. *Alcis sulphuraria* Pack. Midnapore, Alta., July 21; new to Alberta, (Dod).

3862. *Ectropis crepuscularia* D. & S. Edmonton, Alta., May 10-16, (Fernekes). Exactly like British specimens; new to Alberta, (Dod).

4040. *Leucobrephos brephoides* Walk. Midnapore, Alta., flying in sunshine, April 12-19, (Tams).

Cossidæ.

4144. *Cossus populi* Walk. Midnapore, Alta., June 17, July 11, (Tams).

Tortricidæ.

* *Evetria albicapitana* Busck. MacDowell, Sask., (J. C. Blumer); Proc. Ent. Soc., Wash., XVI., Dec., 1914, p. 147.

5207. *Episimus argutanus* Clem. Aweme, Man., Sept. 2, 1913, (Criddle).

Œcophoridæ.

5920. *Epicallima argenticinctella* Clem. Pt. Pelee, Ont., (P. A. Taverner).

Elachistidæ.

* *Heliodines nyctaginella* Gibson. Aweme, Man., July 13, 1913, (Criddle); Can. Ent. XLVI., 423.

Tineidæ.

6363. *Gracilaria rhoifoliella* Chamb. Aweme, Man., Aug. 12, 1913, (Criddle).

6455. *Argyresthia oreasella* Clem. Aweme, Man., June 26, 1913, (Criddle).

Hepialidæ.

6605. *Stenopis quadriguttatus* Grt. Midnapore, Alta., July 10-12, (Tams).

6606. *Stenopis thule* Strk. Winnipeg, Man., July, (Mrs. L. H. Roberts). As mentioned by Lyman (Can. Ent. XXXVII., 31, 1905), there is a specimen in the British Museum collected in Hudson's Bay Territory, the words "Albany River, St. Martin's Falls," being indicated as the exact locality. As Lyman mentioned, the entry on the Museum register applied to a number of specimens received in the same lot, and there was a doubt in his mind as to the locality of the specimen of *thule*. The capture of

the species at Winnipeg, however, shows that it has a wide range of distribution.

6608. *Hepialus hyperboreus* var. *confusus* Hy. Edw. Kaslo, B.C., (Cockle).

COLEOPTERA.

(Arranged according to Henshaw's list of Coleoptera of America, North of Mexico.)

Cicindelidæ.

* *Cicindela pugetana* Csy. "British Columbia, (Knaus)." Memoirs on the Coleoptera V, by Thos. L. Casey, published 28 Nov., 1914.

* *Cicindela calgaryana* Csy. Lethbridge, Alta., (J. Harms); Memoirs on the Coleoptera V, by Thos. L. Casey, published 28 Nov., 1914.

Carabidæ.

324. *Bembiduim recticolle* Lec. Lethbridge, Alta., Aug. 21, 1912, (Wallis).
678. *Amara remotestriata* Dej. Toronto, Ont., June, (Crew).
728. *Dicœlus teter* Bon. Trout Creek, Toronto, Ont., May 17, (Crew).
743. *Calathus ingratus* Dej. St. Jerome, Que., May 13, (Beaulne).
759. *Platynus hypolithos* Say. Grimsby, Ont., Sept. 7, (Brimley).
829. *Platynus sordens* Kirby. St. Rose, Que., May 6, (Beaulne).
895. *Lebia scapularis* Dej. Aweme, Man., Sept. 18, 1908, Oct. 7, 1912, (E. & N. Criddle).
925. *Callida purpurea* Say. Aweme, Man., Aug. 29, 1909, (N. Criddle).
927. *Philophuga amoena* Lec. Aweme, Man., June 29, 1908, May 24, 1913, (N. Criddle).
948. *Cymindis neglecta* Hald. Aweme, Man., June 11, 1911, (N. Criddle).
976. *Brachynus ballistarius* Lec. Hull, Que., July 19, (Beaulne).
1017. *Chlænius nemoralis* Say. Coaticook, Que., Sept. 2, 1913, (Beaulne).
1031. *Chlænius purpuricollis* Rand. Ottawa, May 24, 1913, (Germain).

* *Harpalus lascious* Csy. "British Columbia;" Memoirs on the Coleoptera V, by Thos. L. Casey, published 28 Nov., 1914.

* *Harpalus recensus* Csy. W. St. Modest, Labrador, (Sherman); Memoirs on the Coleoptera V, by Thos. L. Casey, published 28 Nov., 1914.

* *Harpalus fugitans* Csy. "Frazier Valley, B.C."; Memoirs on the Coleoptera V, by Thos. L. Casey, published 28 Nov., 1914.

* *Harpalus plemalis* Csy. "New Brunswick"; Memoirs on the Coleoptera V, by Thos. L. Casey, published 28 Nov., 1914.

* *Trichocellus borcellus* Csy. Queen Charlotte Islands, (Keen); Memoirs on the Coleoptera V, by Thos. L. Casey, published 28 Nov., 1914.

Dytiscidæ.

1293. *Coelambus sellatus* Lec. Winnipeg, Man., Oct. 14, 1911, (Wallis).
1298. *Coelambus unguicularis* Cr. Winnipeg, Man., May 11, 1912, (Wallis).
1325. *Hydroporus vittatus* Lec. Winnipeg, Man., Sept. 30, 1911, (Wallis).
1326. *Hydroporus sericeus* Lec. Winnipeg, Man., May 20, 1911, (Wallis).
1349. *Hydroporus tartaricus* Lec. Winnipeg, Man., April 8, 1911, (Wallis).
1411. *Agabus seriatus* Say. Peachland, B.C., Aug. 2, 1912, (Wallis).
1433. *Agabus anthracinus* Mann. Winnipeg, Man., Oct. 14, 1911, (Wallis).

1439. *Agabus reticulatus* Kirby. Winnipeg, Man., April 8, 1911, (Wallis).
1441. *Agabus lecontei* Cr. Lethbridge, Alta., Aug. 21, 1912, (Wallis).
1498. *Graphoderes liberus* Say. Ottawa, April 3, (Germain).
1499. *Graphoderes fasciatocollis* Harr. Winnipeg, Man., April 21, 1911, (Wallis).
Graphoderes perplexus Sharp. Winnipeg, Man., June 6, 1911, (Wallis).
Graphoderes elatus Sharp. Stony Mt., Man., April 23, 1910, (Wallis).

Hydrophilidæ.

1542. *Helophorus oblongus* Lec. Longueuil, Que., (Emile).

Silphidæ.

1726. *Choleva luridipennis* Mann. Onah, Man., May 24, 1912, in weasel's nest, (Criddle & Wallis).

Scydmænidæ.

1841. *Scydmaenus salinator* Lec. Onah, Man., May 24, 1912, (Criddle & Wallis); Ottawa, July 14, 1913, (Germain).
Euconnus occulatus Csy. Ottawa, July 12, (Germain).

Pselaphidæ.

9361. *Pselaphus bellax* Csy. Winnipeg, Man., April 17, 1911, (Wallis).
1886. *Decarthron abnorme* Lec. Onah, Man., May 24, 1912, (Criddle & Wallis); Husavick, Man., June 22, 1912, (Criddle & Wallis).
1916. *Bryaxis brendelii* Horn. Bird's Hill, Man., (Wallis).
1938. *Bryaxis puncticollis* Lec. Husavick, Man., June 22, 1912, (Criddle & Wallis).

Staphylinidæ.

Aleochara pleuralis Csy. Ottawa, June 27, (Germain).
2096a. *Heterothops fusculus* Lec. Ottawa, May 3, (Germain).
2102. *Quedius peregrinus* Grav. Ottawa, April 14, (Germain).
2166. *Philonthus cautus* Er. Ottawa, July 27, 1913, (Germain).
2462. *Stenus arculus* Er. Ottawa, July 14, 1913, (Germain).
2560. *Lithocharis* (*Trachysectus*) *confluens* Say. Ottawa, Aug. 22, (Germain).
2626. *Tachinus frigidus* Er. Ottawa, April 27, (Germain).

Trichopterygidæ.

2944. *Trichopteryx aspera* Hald. Ottawa, July 19, (Germain).

Corylophidæ.

3011. *Sacium lugubre* Lec. Winnipeg, Man., June 4, 1912, (Wallis).

Coccinellidæ.

3071. *Harmonia 14-guttata* L. Micou Harbour, Que., June 9, (Young).
3073. *Mysia* (*Neomysia*) *pullata* Say. Gaspe, Que., Sept. 9, (Young).

Colydiidæ.

3271. *Lasconotus pusillus* Lec. Peachland, B.C., July 19, 1912, (Wallis).
3290. *Cerylon castaneum* Say. Aweme, Man., June 9, (Criddle); Husavick, Man., June 22, 1912, (Wallis).

Cucujidæ.

3300. *Silvanus bidentatus* Fab. Winnipeg, Man., May 18, 1912, (Wallis).
3326. *Læmophlæus convexulus* Lec. Winnipeg, Man., May 30, 1912, (Wallis).

Cryptophagidæ.

3375. *Cryptophagus nodangulus* Zimm. Ottawa, July 19, 1913, (Germain).

Mycetophagidæ.

3393. *Mycetophagus flexuosus* Say. Winnipeg, Man., May 12, 1912, (Wallis).

Histeridæ.

3482. *Hister immunis* Er. Ottawa, June-Aug., (Germain).
3484. *Hister cognatus* Lec. Ottawa, July 14, under a dead robin, (Germain).
3505. *Hister sedecimstriatus* Say. Ottawa, July 14, under a dead robin. (Germain).
3515. *Hister* (*Phelister*) *subrotundus* Say. Ottawa, June 19, 1913, (Germain).
3524. *Hister* (*Platysoma*) *coarctatus* Lec. Ottawa, May 13, 1913, (Germain).
3525. *Hister* (*Platysoma*) *punctiger* Lec. Ottawa, June 29, 1913, (Germain).
3592. *Saprinus conformis* Lec. Ottawa, June 13, 1913, (Germain).
3614. *Saprinus sphæroides* Lec. Ottawa, under a dead fish, June 3, (Germain).
3633. *Plegaderus transversus* Say. Ottawa, Aug. 3, 1913, (Germain).

Nitidulidæ.

3700. *Epuræa erichsonii* Reit. Winnipeg, Man., June 12, 1912, (Wallis).
3704. *Epuræa immunda* var. *flavomaculata* Makl. Stony Mt., Man., Oct. 8, 1911, (Wallis).

Latridiidæ.

Melanopthalma cavicollis Com. Winnipeg, Man., Sept. 18, 1912, (Wallis).
Coninomus constrictus Gyll. Ottawa, July 13, 1913, (Germain).
Enicmus tenuicornis Lec. Ottawa, July 14, (Germain).
3799. *Corticaria dentigera* Lec. Ottawa, May 27, (Germain).
3818. *Corticaria cavicollis* Mann. Onah, Man., May 24, 1912, (Criddle & Wallis).
Corticaria valida Fall. Husavick, Man., June 22, 1912, (Wallis).

Trogositidæ.

Tenebrioides occidentalis Fall. Peachland, B.C., Aug. 10, 1912, (Wallis).

Heteroceridæ.

3960. *Heterocerus tristis* Mann. Stony Mt., Man., Oct. 8, 1911, (Wallis).
Heterocerus brunneus Melsh. Husavick, Man., June 22, 1912, (Criddle & Wallis).

Elateridæ.

4113. *Cardiophorus tenebrosus* Lec. Victoria, B.C., (Blackmore).
4166. *Oedostethus femoralis* Lec. Aweme, Man., July 3, (Criddle).
4466. *Corymbites sulcicollis* Say. Grimsby, Ont., July 4, 1913, (Brimley).
4476. *Corymbites medianus* Germ. Aweme, Man., July 19, (Criddle).

4484. *Corymbites cruciatus* Linn. Aweme, Man., June 29, 1912, (T. Criddle).
4511. *Hemicrepidius* (*Asaphes*) *bilobatus* Say. Grimsby, Ont., Aug. 3, 1913, (Brimley).

Buprestidæ.

4583. *Dicerca tenebrosa* Kirby. Granville Ferry, N.S., July 27, 1912, (Payne).
4606a. *Buprestis subornata* Lec. Peachland, B.C., July 15, 1912, (Wallis).
4608. *Buprestis sulcicollis* Lec. Ottawa, July 3, 1911, (Germain).

Lampyridæ.

4785. *Eros simplicipes* Mann. Trout Creek, Toronto, May 17, (Crew).
4826. *Pyractomena lucifer* Melsh. Winnipeg, Man., June 24, 1911, (Wallis).
4906. *Podabrus lævicollis* Kirby. Husavick, Man., June 22, 1912, (Wallis).
4932. *Telephorus carolinus* Fab. Husavick, Man., June 22, 1912, (Wallis).
Ditemnus latilobus Blatch. Onah, Man., June 24, 1912, (Criddle & Wallis).

Cleridæ.

5167. *Clerus quadriguttatus* Oliv. Husavick, Man., Sept. 24, 1912, (Coates).
5215a. *Chariessa onusta* Say. Carp, Ont., July 21, (Gibson).

Cioidæ.

Cis pistoria Csy. Winnipeg, Man., May 18, 1912, (Wallis).
Octotemnus denudatus Csy. Winnipeg, Man., May 18, 1912, (Wallis).

Scarabæidæ.

5468. *Aegialia lacustris* Lec. Ottawa, July 3, 1913, (Germain).
5514. *Aphodius erraticus* L. Ottawa, May-July, (Germain); Hull, Que., May 12, (Kitto).
5538. *Ophodius leopardus* Horn. Aylmer, Que., July 3, 1913, (Germain).
5771. *Lachnosterna marginalis* Lec. Strathroy, Ont., June 23, 1913, on hazel, (H. F. Hudson).
5777. *Lachnosterna ilicis* Knoch. Strathroy, Ont., June 30, on locust, (H. F. Hudson).
10,235. *Lachnosterna inversa* Horn. Strathroy, Ont., June 23, 1913, on elm, (H. F. Hudson).
5925. *Cremastochilus knochii* Lec. Aweme, Man., May 14, June 10, (Criddle).

Cerambycidæ.

5967. *Tragosoma harrisii* Lec. Winnipeg, Man., July, (L. H. Roberts).
6007. *Merium proteus* Kirby. Aweme, Man., June 9, (Criddle).
6099. *Molorchus longicornis* Lec. Maple Bay, V. I., B.C., July 19, only one taken before (Victoria); appears to be quite rare, (Hanham).
6229. *Pyrotrichus vitticollis* Lec. Quamichan Lake, V.I., B.C., April 26, May 2, (Hanham).

Chrysomelidæ.

6551. *Zeugophora scutellaris* Suffr. Lethbridge, Alta., June, 1913, (Strickland).
6558. *Syneta carinata* Mann. Little Current River, (Hudson Bay Slope) Ont., July 20, 1903, (W. J. Wilson).

6559. *Syneta albida* Lec. Agassiz, B.C., May, 1913, (Gibson).
6560. *Syneta simplex Lec.* Inverness, B.C., June, 1910, (Keen).
6679. *Pachybrachys peccans* Suffr. Winnipeg, Man., June 17, 1911, (Wallis).

Bruchidæ.

7147. *Bruchus calvus* Horn. Aylmer, Que., July 8, 1912, (Germain).

Tenebrionidæ.

7530. *Hypophlœus substriatus* Lec. Husavick, Man., June 22, 1912, (Wallis).

Melandryidæ,
Pisenus humeralis Kirby. Ottawa, Aug. 8, 1913, (Germain).
7649. *Penthe obliquata* Fab. Husavick, Man., Aug. 27, 1910, (Wallis).
7665. *Euchodes sericea* Hald. Aweme, Man., July 1, 1913, (E. Criddle).
7666. *Serropalpus barbatus* Schall. Granville Ferry, N.S., (Payne); Grimsby, Ont., July 1, (Brimley).
7696. *Stenotrachelus arctatus* Say. Banff, Alta., Oct. 5, 1912, (Sanson).

Pythidæ.

7707. *Crymodes discicollis* Lec. Micou Harbour, Que., June 16, (Young).
7717. *Salpingus virescens* Lec. Husavick, Man., June 22, 1912, (Wallis).

Mordellidæ.

7846. *Mordellistena unicolor* Lec. Ottawa, July 18, 1913, (Germain).

Anthicidæ.

7868. *Nematoplus collaris* Lec. Ottawa, May 8, 1913, (Germain).
7940. *Anthicus formicarius* Laf. Onah, Man., May 24, 1912, (Criddle & Wallis).
7943. *Anthicus californicus* Laf. Winnipeg, Man., April 27, 1911, (Wallis).
7957. *Anthicus flavicans* Lec. Winnipeg, May 13, 1911, (Wallis).
7975. *Anthicus coracinus* Lec. Winnipeg, Man., April 17, 1911, (Wallis).
Anthicus (*Sapintus*) *festivans* Csy. Winnipeg, Man., April 17, 1911, (Wallis).

Pyrochroidæ.

7992. *Pyrochroa femoralis* Lec. Grimsby, Ont., June 15, (Brimley).

Meloidæ.

8084. *Epicauta pruinosa* Lec. Winnipeg, Man., June 17, 1911, (Wallis). New to Manitoba.

Rhinomaceridæ.

8199. *Rhinomacer bombifrons* Lec. Banff, Alta., May 20, 1909, (Sanson).

Otiorhynchidæ.

10,796. *Barypithes pellucidus* Boh. Ottawa and Montreal, June, July, 1913, (Germain).
8334. *Scythropus elegans* Coup. Banff, Alta., April 29, 1911, (Sanson).
Ceutorhynchus cyanipennis Ill. Ottawa, July 26, 1913, (Germain).

Curculionidæ.

8346. *Sitones hispidulus* Germ. Ottawa, June 2, (Germain).
8357. *Trichalophus simplex* Lec. Banff, Alta., June 21, 1912, (Sanson).
8436. *Lepyrus gemellus* Kirby. Banff, Alta., July 15, 1912, (Sanson).
8514. *Stephocleonus cristatus* Lec. Monarch, Alta., May 5, 1913, (Gibson).
8581. *Linellus friliformis* Lec. Ottawa, (Germain).
Elleschus scanicus Payk. Ottawa, July 12, 1913, (Germain).

Diptera.

(Arranged according to a Catalogue of North American Diptera, by J. M. Aldrich, Smithsonian Misc. Coll. XLVI, No. 1,444. The numbers refer to the pages in the catalogue).

Many of the species of diptera here recorded are well known, but they are included owing to the fact that their collection in the localities indicated extend the known distribution of most of them. Bro. Germain, of Ottawa, has collected most industriously, and to his zeal we are able to record many of his captures, the determinations having been largely made by Mr. C. W. Johnson, of the Boston Museum of Natural History.

Tipulidæ.

101. *Tipula caloptera* Loew. Ottawa, July, 1913, (Germain).
* *Tipula ottawaensis* Dietz. Aweme, Man., June 27, 28, July 30, 1913, Aug. 4, 1912, (Criddle); Aylmer, Que., April 24, June, 1913, (Beaulne); Ottawa, June 28, July 11, 13, (Beaulne); Trans. Amer. Ent. Soc., XL, 349, Dec., 1914.
* *Tipula criddlei* Dietz. Aweme, Man., June 1-20, July 20, 1912, (Criddle); Trans. Amer. Ent. Soc., XL, 360, Dec., 1914.

Chironomidæ.

115. *Orthocladius nivoriundis* Fitch. Ottawa, May 11, 1913, (Germain).
115. *Camptocladius byssinus* Schrank. Ottawa, May 23, 1913, (Germain).
118. *Tanypus bifasciatus* Coq. Ottawa, June 1, 1913, (Germain).
118. *Tanypus monilis* L. Ottawa, June 1, 1913, (Germain).

Mycetophilidæ.

142. *Acnemia flaveola* Coq. Montreal, Que., July, (Beaulieu).
151. *Sciara sciophila* Loew. Lethbridge, Alta., July 22, 1913, (Strickland).

Cecidomyidæ.

* *Hormomyia bulla* Felt. "Province of Ontario, Brodie"; Can. Ent. XLVI, 286.
* *Rhabdophaga swainei* Felt. Ottawa, May, (Swaine); Ottawa Naturalist, XXVIII, 77.

Bibionidæ.

167. *Dilophus stigmaterus* Say. Lethbridge, Alta., Aug. 5, (Strickland).
168. *Scatopse pygmæa* Loew. Lethbridge, Alta., July 21, 1913, (Strickland).

Simuliidæ.

* *Simulium arcticum* Malloch. Kalso, B.C., (H. G. Dyar); Bear Lake, B.C., (R. P. Currie); U. S. Dept. Agr., Bull. Tech. Series No. 26, p. 37.

* *Prosimulium mutatum* Malloch. Kaslo, B.C., (H. G. Dyar); U. S. Dept. Agr., Bull. Tech. Series No. 26, p. 20.

* *Prosimulium pleurale* Malloch. Kalso, B.C., (R. P. Currie); U. S. Dept. Agr., Bull. Tech. Series No. 26, p. 17.

Rhyphidæ.

172. *Rhyphus alternatus* Say. Ottawa, May 12, 1913, (Germain).
172. *Rhyphus punctatus* Fab. Ottawa, June 8, 1913, (Germain).

Stratiomyidæ.

178. *Chrysochroma nigricornis* Loew. Ottawa, May 3, (Germain).
179. *Sargus cuprarius* L. Ottawa, July 20, (Germain).
180. *Sargus viridis* Say. Lethbridge, Alta., June 28, (Strickland); Ottawa, Aug. 12, (Germain).
180. *Microchrysa polita* L. Ottawa, June 8, (Germain).
180. *Macrosargus clavis* Will. Ottawa, July 1, (Germain).
186. *Odontomyia pilimanus* Loew. Ottawa, (Germain).
187. *Odontomyia virgo* Wied. Ottawa, May 21, (Germain).
190. *Nemotelus crassus* Loew. Ottawa, June 28, (Germain).
190. *Nemotelus unicolor* Loew. Ottawa, June 28, (Germain).

Tabanidæ.

195. *Chrysops æstuans* V. d. Wulp. Ottawa, (Germain).
198. *Chrysops striatus* O. S. Ottawa, June 24, (Germain).
201. *Tabanus astutus* O. S. Aylmer, Que., May 3, (Germain).
204. *Tabanus hirtulus* Bigot. Aweme, Man., (Criddle).
204. *Tabanus lasiophthalmus* Macq. Aweme, Man., June 17, (Criddle).
207. *Tabanus sonomensis* O. S . Aweme, Man., June 14, (Criddle).

Leptidæ.

215. *Leptis mystacea* Macq. Ottawa, June 24, (Germain).
215. *Leptis scapularis.* Ottawa, June 21, (Germain).
216 *Chrysophila proxima* Walk. Ottawa, June 24, (Germain).

Cyrtidæ.

220. *Oncodes pallidipennis* Loew. Ottawa, Aug. 14, (Germain).

Bombyliidæ.

223. *Spogostylum limatulus* Say. Ottawa, June 14, (Germain).
230. *Anthrax fulviana* var. *nigricauda* Loew. Ottawa, June 8, (Germain).
232. *Anthrax morio* L. Ottawa, May and June, (Germain).
234. *Anthrax tegminipennis* Say. Ottawa, June 8, (Germain).
234. *Anthrax tegminipennis* var. *sachenii* Coq. Lethbridge, Alta., Sept. 16, 1913, (Strickland). Mr. C. W. Johnson when determining this specimen reported "probably a good species."
247. *Psilocephala hæmorrhoidalis* Macq. Ottawa, June 10, (Germain).
248. *Thereva flavicincta* Loew. Otttawa, June 10, (Germain).

Asilidæ.

254. *Leptogaster bodius* Loew. Ottawa, (Germain).
254. *Leptogaster flavipes* Loew. Ottawa, May 8, (Germain).
262. *Stichopogon trifasciatus* Say. Ottawa, June 10, (Germain).
269. *Pogonosoma dorsatum* Say. Ottawa, June 10, (Germain). This is a rare species in the east. Mr. C. W. Johnson who made the determination states that this is the second record from the east since the species was described from "near Philadelphia."
283. *Asilus sadyates* Walk. Ottawa, June 10, (Germain). Only recorded from Ohio in Aldrich's catalogue.

Dolichopodidæ.

285. *Psilopodinus inermis* Loew. Ottawa, July 20, (Germain).
288. *Diaphorus mundus* Loew. Montreal, Que., July, (Beaulieu).
* *Medeterus emarginatus* Van Duzee. Kearney, Ont., July 6, 1909; Ent. News, XXV, 439.
297. *Hydrophorus æstuum* Loew. Ottawa, Aug, 17, (Germain).
297. *Scellus exustus* Walk. Ottawa, Aug 14, (Germain).
300. *Dolichopus comatus* Loew. Ottawa, July, (Germain).

Empididæ.

310. *Stilpon varipes* Loew. Montreal, Que., April, (Beaulieu).
311. *Drapetis medetera* Mel. Ottawa, July 27, (Germain).
325. *Hilaria leucoptera* Loew. Montreal, Que., July, (Beaulieu).

Lonchopteridæ.

333. *Lonchoptera lutea* Panz. Montreal, Aug., (Beaulieu).

Pipunculidæ.

343. *Pipunculus similis* Hough. Ottawa, July 23, (Germain).
Pipunculus affinis Cress. Jr. In the Transactions of the American Ent. Soc. XXXVI, p. 283, the locality of this species is given as "Cottage Beaulieu, (Beaulieu) Que." This should be corrected to read—Montreal, Que., (Beaulieu).

Syrphidæ.

349. *Chrysogaster pictipennis* Loew. Ottawa, (Germain).
351. *Paragus angustifrons* Loew. Ottawa, July 27, (Germain).
361. *Melanostoma obscurum* Say. Ottawa, June 8, (Germain).
393. *Helophilus integer* Loew. Ottawa, June 8, (Germain).
402. *Criorhina decora* Macq. Ottawa, reared from larva found in rotten wood, May 3, (Germain).

Conopidæ.

412. *Oncomyia abbreviata* Loew. Ottawa, July 11, 27, (Germain).

Tachinidæ.

451. *Ocyptera dorsiades* Wlk. Ottawa, July, (Germain).
482. *Microphthalma disjuncta* Wied. Ottawa, Aug. 3, (Germain).

Dexiidæ.

500. *Myiocera rava* V. d. Wulp. Ottawa, July 11, (Germain).
504. *Ptilodexia tibialis* Desv. Ottawa, Aug. 4, 12, (Germain).
507. *Thelaira leucozona* Panz. Ottawa, Aug. 8., (Germain).
* *Sarcophaga kellyi* Ald. Aweme, Man., (N. Criddle); Journ. Agr. Research, U. S. Dept. Agr., Sept. 21, 1914, p. 443.

Sarcophagidæ.

* *Ravinia communis* Parker. "Canada"; Proc. Boston Soc. Nat. History, Vol. 35, p. 55.
* *Ravinia latisetosa* Parker. "Canada"; Proc. Boston Soc. Nat. History, Vol. 35, p. 63.

Muscidæ.

523. *Lucilia sylvarum* Meig. Ottawa, Aug. 23, (Germain).
525. *Pyrellia serena* Meig. (=*cyanicolor* Zett.), Ottawa, July 14, (Germain).
* *Hypodermodes solitaria* Knab. High River, Alta., (Baird); Can. Ent. XLVI, 326.

Anthomyidæ.

540. *Hyetodesia deleta* Stein. Ottawa, July 20, (Germain).
542. *Hyetodesia serva* Meig. Ottawa, Aug. 3, (Germain).
545. *Spilogaster nitens* Stein. Ottawa, Sept. 14, (Germain); Montreal, Que., July, (Beaulieu).
545. *Spilogaster signia* Walk. Ottawa, July 12, (Germain).
546. *Limnophora compuncta* Wied. Ottawa, Aug. 24, (Germain).
551. *Hydrophoria devisa* Meig. Montreal, Que., June, July, (Beaulieu).
557. *Phorbia ruficeps* Zett. Ottawa, Aug. 8, (Germain).
561. *Cœnosia lata* Walk. Montreal, Que., July, (Beaulieu).
561. *Cœnosia pallipes* Stein. Rigaud, Que., Montreal, Que., June, Aug., (Beaulieu).
563. *Schœnomyza dorsalis* Loew. Montreal, Que., Aug., (Beaulieu).
563. *Lispa albitarsis* Stein. Montreal, Que., July, (Beaulieu); Ottawa, Aug 17, (Germain).

Scatophagidæ.

565. *Cordylura confusa* Loew. Ottawa, Aug 3, (Germain).
566. *Parallelomma varipes* Walk. Ottawa, June 21, Aug 12, (Germain).
569. *Scatophaga merdaria* Fab. Ottawa, May-Aug., (Germain).

Sciomyzidæ.

578. *Sciomyza obtusa* Fallens. Ottawa, Aug. 12, (Germain); Montreal, Que., July, (Beaulieu).
Dryomyza varia Coq. Ottawa, July 27, (Germain). Second specimen I have seen, (C. W. J.).
579. *Tetanocera flavescens* Loew. Ottawa, (Germain).
579. *Tetanocera pallida* Loew. Ottawa, Aug. 8, (Germain).
579. *Tetanocera lineata* Day. Ottawa, Aug. 8, (Germain). Malloch, Can. Ent. XLVI, 324, says: "This species belongs to the genus *Hidroneura* Handel and is synonymous with *H. rufa* Panzer of the European fauna.
581. *Sepedon fuscipennis* Loew. Ottawa, Aug. 14, 24, (Germain).

Sapromyzidæ.

582. *Lonchæa polita* Say. Ottawa, July 27, Aug. 24, (Germain).
584. *Sapromyza bispina* Loew. Ottawa, Aug. 8, (Germain).

Ortalidæ.

589. *Rivellia viridulans* Desv. Ottawa, Aug. 8, (Germain).
592. *Melieria similis* Loew. Ottawa, July, (Germain).

Trypetidæ.

606. *Rhagoletis pomonella* Walsh. Lethbridge, Alta., July 19, (Strickland). The capture of this specimen in Southern Alberta extends very much the known distribution in Canada of this very injurious insect.
611. *Tephritis angustipennis* Loew. Ottawa, July, (Germain).
612. *Tephritis geminata* Loew. Ottawa, July 6, (Germain).
613. *Euaresta festiva* Loew. Ottawa, July 27, (Germain).

Micropezidæ.

616. *Calobata antennipes* Say. Ottawa, June 24, (Germain).

Ephydridæ.

623. *Notiphila scalaris* Loew. Montreal, Que., July, (Beaulieu).
627. *Hydrellia ischiaca* Loew. Montreal, Que., July, (Beaulieu).
628. *Pelina truncatula* Loew. Montreal, Que., Aug., (Beaulieu).
629. *Parydra pinguis* Walk. Montreal, Que., July, (Beaulieu).

Oscinidæ.

633. *Chlorops grata* Loew. Ottawa, Aug. 12, (Germain).
633. *Chlorops melanocera* Loew. Ottawa, July 3, (Germain).
637. *Gaurax festivus* Loew. Lethbridge, Alta., July 8, 1913, (Strickland).
Hippelates longulus. Prof. J. M. Aldrich recently informed me (27. VII, 1914) that "there is a *Hippelates longulus* described by Becker (Annales Mus. Nat. Hung. X, 89, 1912, with the locality '1 exemplar aus Kanada (Coll. Aldrich).' The specimen was returned to me and I see that the locality was incorrectly stated; it should read Grenada, W. I. Hence the species should not be recorded from Canada."

Drosophilidæ.

643. *Drosophila graminum* Fall. Montreal, Que., Aug., (Beaulieu).

Geomyzidæ.

645. *Anthomyza terminalis* Loew. Montreal, July, (Beaulieu).

Agromyzidæ.

646. *Ptytomyza obscurella* var. *illicicola* Loew. Hull, Que., reared from leaves of *Ilex verticillata* var. *tenuifolia,* (Gibson).
647. *Agromyza angulata* Loew. Montreal, Que., July, (Beaulieu).
652. *Leucopsis nigricornis* Egger. Ottawa, Aug. 12, (Germain).

HYMENOPTERA.

Considerable collecting was done in this order in various parts of Canada during 1914, but much of the material has not as yet been worked up. The following records seem worthy of inclusion now.

Xyelidæ.

Macroxyela distincta MacG. Ottawa, Aug. 21, (Germain). Not previously recorded from Canada.

Tenthredinidæ.

Dolerus luctatus MacG. Ottawa, July 3, (Germain). Not previously recorded from Canada.
Dolerus conjugatus MacG. Ottawa, (Germain).
Dolerus dysporus MacG. Ottawa, (Germain).
Dolerus neocollaris MacG. Ottawa, June 12, 1913, (Germain).
Dolerus neoaprilis MacG. Ottawa, June 3, 1913, (Germain).
* *Astochus fletcheri* MacG. Kaslo, B.C., May 28, 1906, (Fletcher). Can. Ent. XLVI, 108.
Tenthredo angulifera Nort. Ottawa, July 28, 1913, (Germain).
Tenthredo basalaris Say. Ottawa, July 17, (Germain).
Macrophya epinota Say. Ottawa, July 3, (Germain).
Macrophya pannosa Say. Ottawa, July 18, (Germain).
Pachynematus pubescens Marl. Ottawa, Aug. 27, (Germain). Not previously recorded from Canada.
Monophadnus bipunctatus MacG. Ottawa, June 27, 1913, (Germain).
Monophadnoides conspicuous MacG. Ottawa, July 30, 1913, (Germain).
* *Metallus bethunei* MacG. Jordan Harbour and St. Catharines, Ont., reared from a leaf mining larva on blackberry, (Caesar). Can. Ent. XLVI, 367.

Xiphydridæ.

Xiphydria maculata Say. Ottawa, July 27, (Germain).
Xiphydria provancheri Cress. Ottawa, Aug. 3, (Germain). Harrington has taken the species at Hull, Que., (June 15).

Cephidæ.

Janus abbreviatus Say. Ottawa, Aug. 3, 1913, (Germain).

Cynipidæ.

Rhodites gracilis Beut. Toronto, Ont., (Cosens).

Braconidæ.

Microplitis alaskensis Ashm. Kelowna, B.C., June, (Ruhmann).

Ichneumonidæ.

* *Ephialtes brevis* Morley. District of Hudson's Bay (Albany River, St. Martin's Falls, etc.), 1844, (George Barnston). Revision of the Ichneumonidæ, Part III, p. 23, (British Museum) by C. Morley.
* *Apachtis rugulosa* Morley. Inverness, B.C., 1890, (Keen). Revision of the Ichneumonidæ, Part III, p. 34, (British Museum) by C. Morley.

Ichneumon cervulus Prov. Smith's Cove, N.S., July 15, (Gibson).
Ichneumon milvus Cr. Smith's Cove, N.S., July 15, (Gibson).
Ichneumon subdolus Cr. Smith's Cove, N.S., July 15, (Gibson).
Ichneumon trizonatus Prov. Smith's Cove, N.S., July, (Gibson).
Amblyteles belangeri Cr. Smith's Cove, N.S., July, (Gibson).

Crabronidæ.

Crabro (*Protothyreopus*) *dilectus* Cr. Aweme, Man., Aug. 3-13, (Criddle); Trout Creek and Thompson River, July 22-Aug. 12, (Wilson).

Andrenidæ.

Andrena bicolor Prov. Truro, N.S., May 18, 1913, (C. B. Gooderham); Aweme, Man., May 8-14, (Criddle).
Andrena fragariana Graen. Ottawa, May 10, (Sladen).
Andrena helianthi Robt. Toronto, Ont., Sept. 9, 1888, (Dr. Brodie).

Anthophoridæ.

Clisodon terminalis Cr. Shawnigan, Van. Is., B.C., (Sladen): Ste. Anne de la Pocatiere, Que., (Sladen).
Anthophora occidentalis Cr. Lethbridge, Alta., June 28, (Sladen).

Megachilidæ.

Megachile vidua Sm. Laggan, B.C., Vancouver Island, B.C., Charlottetown, P.E.I., (Sladen).

Bombidæ.

Bombus borealis Kirby. Scott, Sask.; Rosthern, Sask., (Sladen).
Bombus couperi Cr. Painsec, N.B., Aug. 4, (Sladen).
Bombus centralis Cr. Invermere, B.C.; Vernon, B.C., (Sladen).
Bombus edwardsii Cr. Without red band, Invermere, B.C.; with red band, Sidney, B.C., (Sladen).
Bombus flavifrons Cr. Agassiz, B.C., (Sladen).
Bombus frigidus Cr. Invermere, B.C., June 30, (Sladen).
Bombus huntii Greene. Rosthern, Sask., (Sladen).
Bombus nevadensis Cr. Invermere, B.C., (Sladen); Lethbridge, Alta., (Strickland).
Bombus terricola Kirby. Salmon Arm, B.C., (Sladen). Not previously recorded from British Columbia.

Hemiptera.

As far as we know little systematic collecting in this order has been effected throughout Canada during 1914. Among the material studied the following species seem worthy of record here.

Cicadidæ.

Cicada canicularis Harr. Aweme, Man., Aug.-Sept., (N. & T. Criddle).
Okanogana noveboracensis Em. Treesbank, Man., June 14, (E. Criddle).

Psyllidæ.

* *Livia caricis* Crawford. Glacier, B.C., (Hubbard & Schwarz); Bull. 85, U. S. N. M., p. 23.

* *Arytaina fuscipennis* Crawford. North Bend, B.C., (Schwarz); Bull. 85, U. S. N. M., p. 112.

* *Psylla sinuata* Crawford. Ungava Bay, Labrador, July 22, (L. M. Turner); Bull. 85, U. S. N. M., p. 140.

* *Psylla americana* Crawford. Banff, Alta., June, (Hubbard & Schwarz); Bull. 85, U. S. N. M., p. 147.

* *Psylla americana flava* Crawford. Victoria, B.C., (Hubbard & Schwarz); Bull. 85, U. S. N. M., p. 147.

Aphididæ.

Phylloxera castaneæ Hald. Vineland, Ont., Sept. 18, on chestnut, (Ross).

Hamamelestes spinosus Shimer. Vineland, Ont., June 22, on *Betula papyrifera,* (Ross).

Tetraneura graminis Monell. Vineland, Ont., July 7, on *Ulmus americana,* (Ross).

Tetraneura ulmisacculi Patch. Vineland, Ont., June 29, on *Ulmus montana,* (Ross).

Aphis cardui L. Vineland, Ont., on *Cirsium lanceolatum* and Cinerarias, (Ross).

Aphis pseudobrassicae Davis. Aweme, Man., Oct. 24, (Criddle). This recently described species doubtless occurs in other localities.

Aphis rufomaculata Wils. Grimsby, Ont., Nov. 16, on chrysanthemums, (Ross).

Rhopalosiphum lactucæ Kalt. Vineland, Ont., July 9, on *Sonchus asper,* (Ross).

Rhopalosiphum ligustri Kalt. Vineland, Ont., on *Ligustrum vulgare,* (Ross).

The arrangement of the Hemiptera-Heteroptera follows Bank's Catalogue, (Amer. Ent. Soc'y, 1910): the numbers refer to the pages in the catalogue.

Nepidæ.

8. *Nepa apiculata* Harr. Ottawa, June 24, (Germain).

Saldidæ.

12. *Salda pallipes* Fabr. Ottawa, July 26, 1912, (Germain).

Anthocoridæ.

Anthocoris repertus Uhl. Ottawa, June 20, 1912, (Germain).

24. *Piezostethus sordidus* Reut. Ottawa, Aug. 8, 1913, (Germain).

Gerridæ.

Gerris buenoi Kirkaldy. Ottawa, Aug. 10, 1913, (Germain).

Capsidæ.

Chlamydatus associatus Uhl. Bowmanville, July 18, 1913, (Ross).
Phytocoris scrupeus Say. Moose Jaw, Sask., (Johnson).

Aradidæ.

53. *Aradus cinnamoneus* Panz. Ottawa, July 12, 1913, (Germain).
54. *Aneurus inconstans* Uhler. Ottawa, (Germain).
55. *Corythuca marmorata* Uhler. Ottawa, June 20, 1913, (Germain).

Lygæidæ.

58. *Cymus angustatus* Stal. Ottawa, Aug. 10, 1913, (Germain).
58. *Cymus discors* Horv. Ottawa, Aug. 20, 1913, (Germain).
60. *Phlegyas abbriatus* Uhl. Ottawa, July-Aug., (Germain).
62. *Nysius coloradensis* Baker. Ottawa, June 2, 1913, (Germain).
Nysius providus Uhl. Ottawa, June 27, 1913, (Germain).
65. *Ligyrocoris costalis* Van D. Ottawa, June 27, 1913, (Germain).
66. *Ozophora picturata* Uhl. Ottawa, July 13, 1913, (Germain).
68. *Scolopostethus atlanticus* Horv. Ottawa, July 13, 1913, (Germain).
68. *Trapezonotus rufipes* Stal. Ottawa, June 27, 1913, (Germain).
69. *Geocoris bullatus* Say. Ottawa, June 2, 1913, (Germain).

Corcidæ.

* *Ceraleptus pacificus* Barker. "Vancouver Island"; Jour. N. Y. Ent. Soc. XXII, 167.

Orthoptera.

Grylloblattidæ.

* *Grylloblatta campodeiformis* Walker. Sulphur Mountain, Banff, Alta., June 29, 1913, (Walker); Can. Ent., XLVI, 94.

Mantidæ.

Mantis religiosa L. A specimen of this European Praying Mantis was received at the Entomological Branch on Oct. 10, 1914, from Mr. J. H. Herrington, Carrying Place, Ont. Dr. E. M. Walker informs me that the insect was also found at Picton, Ont., and through Prof. C. J. S. Bethune I learned of a specimen which was taken near Simcoe, Ont. These are the first records we have from Canada.

Phasmidæ.

Diapheromera femorata Say. Miami, Man., July 25, 1914 (Wallis); Morden, Man., Aug., 1914, (T. South).

Acridiidæ.

Tettix hancocki Morse. Edmonton, Alta., Aug. 19, 1913, (Walker). First Alberta record.
Chorthippus curtipennis Harris. Spruce Brook, Newfoundland, July 27, 1914, nymphs, (Walker).

Gomphocerus clavatus Thom. Prince Albert, Sask., June 23-26, 1913, (Walker). The most northerly record for this species.

Podisma glacialis var. *variegata* Scudd. Guelph Jct., in a swamp, Sept. 29, (Caesar). Most southern record in Ontario. Dr. E. M. Walker has taken it at Lake Simcoe, Ont., and at points farther north and west.

Melanoplus bruneri Scudd. Aweme, Man., Aug. 26-27, (Criddle).

Melanoplus fasciatus Walk. Aweme, Man., Sept. 9, 17, (Criddle).

Melanoplus infantilis Scudd. Aweme, Man., Aug. 11, 16, (Criddle).

Melanoplus packardii. Fort William, Ont., Aug. 2, 1910, (Walker).

Locustidæ.

Scudderia pistillata Brunn. Edmonton, Alta., Aug. 19, 1913, (Walker).

Scudderia furcata Brunn. Kaslo, B.C., Sept. 22, 1906, (Cockle).

* *Scudderia curvicauda borealis* Rehn & Hebard. Aweme, Man., Aug. 19, 1909, (Criddle); Trans. Amer. Ent. Soc. XL, 281, Dec., 1914.

Orchelimum manitobense E. Walk. Go-Home Bay, Ont., July 23, 1907, July 24-30, 1908 (Walker). First Ontario records.

Xiphidion ensiferum Scudd. Near Rondeau Park, Kent Co., Ont., Sept. 15, 1899, (Walker). A single long-winged female. First Canadian record.

Tropidischia xanthostoma Scudd. Departure Bay, Vancouver Island, B.C., July, 1908, (A. G. Huntsman). First Canadian record.

Diestrammena marmorata De Haan. Guelph, Ont., July 24, 1906, (Collector unknown). An introduced species from Japan, probably taken in a greenhouse.

Ceuthophilus maculatus Say. Winnipeg, Man., Oct. 2, 1911, (Wallis). First Manitoba record.

Gryllidæ.

Œcanthus nigricornis quadripunctatus Beut. Okanagan Landing, B.C., Aug. 16, 1913, (Walker). First British Columbia record.

ODONATA.

Agrionidæ.

Agrion maculatum Say. Sydney, N.S., July 24, 1914, (Walker). First record from Nova Scotia.

Cœnagrionidæ.

Cœnagrion interrogatum Selys. Nipigon, Ont., June, 1913; Spruce Brook, Nfld., July 27, 29, 1914, (Walker). First records from Ontario and Newfoundland.

Ischnura verticalis Say. Picton, N.S., July 22, 1914; Sydney, N.S., July 24, 1914; Spruce Brook, Nfld., July 29, 1914, (Walker). First records from Nova Scotia and Newfoundland.

Enallagma hageni Selys. Sydney, N.S., July 24, 1914.

Aeshnidæ.

Ophiogomphus severus Hag. Saskatoon, Sask., June 24, July 14, 1914, (Willing).

Gomphus notatus Rambur. Lake Timiskaming, Ont., July 7, 1914, two females with exuviæ, freshly emerged. (C. W. Nash.) First Ontario record.

Aeshna tuberculifera E. Walk. De Grassi Point, Lake Simcoe, Ont., Sept. 10, 1914 (Walker).

Aeshna umbrosa E. Walk. Spruce Brook, Nfld., July 27, 1914, nymph, (Walker). First Newfoundland record.

Anax junius Drury. Saskatoon, Sask., Aug. 30, 1914, (Willing); Buffalo Lake, May 30, 1914 (Johnson). First Saskatchewan records.

Libellulidæ.

Pantala flavescens Fab. Husavick, Man., Aug. 6, 1914, (Wallis). First Canadian record.

Neuropteroid Insects (Except Odonata).

(Arranged according to a Catalogue of the Neuropteroid Insects (except Odonata) of the United States, by Nathan Banks; American Entomological Society, 1907. The numbers refer to the pages of the catalogue.)

Neuroptera.

Hemerobiidæ.

24. *Hemerobius conjunctus* Fitch. Magpie, Que., July 19, (Walker).
25. *Psectra diptera* Burm. Toronto, Aug. 10, (Walker). First Canadian record.

Chrysopidæ.

27. *Chrysopa chi* Fitch. Pictou, N.S., July 22, (Walker).
27. *Chrysopa nigricornis* Burm. De Grassi Point, Ont., Aug. 24, (Walker).
28. *Chrysopa rufilabris* Burm. Toronto, July 14, (Walker).

Coniopterygidæ.

29. *Conwentzia hageni* Banks. Toronto, Aug. 31, (Walker). First Canadian record.

Trichoptera.

Limnephilidæ.

* *Limnephilus æqualis* Banks. Bon Accord, B.C., June 7, (Russell); Can. Ent. XLVI, 150.

* *Limnephilus argenteus* Banks. Nepigon, Ont., June 18, (Walker); Can. Ent., XLVI., 152.

* *Limnephilus secludens* Banks. Penticton, B.C., Aug. 9, (Wallis), and Saskatchewan, July; Can. Ent., XLVI, 152.

* *Anisogamus disjunctus* Banks. Bon Accord, B.C., May and June, (Russell); Can. Ent., XLVI, 156.

* *Stenophylax hesperus* Banks. Departure Bay, B.C., Aug. 1, (Walker); Can. Ent., XLVI, 152.

Rhyacophilidæ.

* *Glossosoma penitus* Banks. Peachland, B.C., July 21, (Wallis); Can. Ent., XLVI, 202.
* *Rhyacophila bipartita* Banks. Banff, Alta., Aug. 30, (Sanson); Can. Ent., XLVI, 201.
* *Rhyacophila bifila* Banks. Vernon, B.C., Aug. (Bryant); Can. Ent., XLVI, 201.

Leptoceridæ.

* *Leptocerus futilis* Banks. Go-Home Bay, Ont., July 11, (Walker); Can. Ent., XLVI, 264.
* *Leptocerus retactus* Banks. Muskoka River, Ont., June 30, and Go-Home Bay, Ont., Aug. 8, (Walker).
* *Leptocerus angustus* Banks. Go-Home Bay, Ont., Aug. 1, (Walker); Can. Ent., XLVI, 263.
* *Molanna flavicornis* Banks. Husavick, Man., July, and Winnipeg, Man., May, (Wallis); Can. Ent., XLVI, 261.
* *Œcetina interjecta* Banks. Go-Home Bay, Ont., Aug. 23, (Walker); Can. Ent., XLVI, 262.

Hydropsychidæ.

* *Hydropsyche slossonæ* var. *recurvata* Banks. Go-Home Bay, Ont., (Walker); Can. Ent. XLVI., 253.
* *Holocentropus longus* Banks. Digby, N.S., June, (Russell); Can. Ent. XLVI, 258.

Siphonaptera.

The following species were determined by the Hon. N. Charles Rothschild:

Ceratophyllus wagneri. Aweme, Man., Oct. 9, 1913, on *Evotomys gapperi,* (Criddle).

Certophyllus gallinæ. Aweme, Man., Sept. 26, 1913, from nest of *Asio willsonianus,* also from *Evotomys gapperi,* (Criddle).

Ceratophyllus vison. Ste. Anne de Bellevue, Que., on red squirrel, (Swaine).

Ctenophthalmus pseudargyretes. Aweme, Man., Oct. 19, 1913, on *Evotomys gapperi,* (Criddle).

Leptopsylla selenis. Aweme, Man., Oct. 19, 1913, on *Evotomys gapperi,* (Criddle).

Hystrichopsylla americana. Aweme, Man., Oct. 19, 1913, (Criddle). Mr. Rothschild, when reporting upon this species said: "It is a rare species which is only (as far as I know) represented in the Smithsonian Institution and, by one example, in my own collection."

Acarina.

Tetranychus pilosus C. and F. Vineland, Ont., on plum, (Ross); Prof. Caesar informs me that the species is common in Ontario. Specimens were determined by Dr. Banks.

Tetranychus bicolor Banks. Vineland, Ont., on *Quercus,* (Ross).

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