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AUTHOR'S EDITION FROM ANNUAL REPORT ON EXPERIMENTAL FARMS FOR THE YEAR 1908-9

## CANADA

# DEPARTMENT OF AGRICULTURE

# CENTRAL EXPERIMENTAL FARM

# REPORT OF THE DIVISION OF ENTOMOLOGY AND BOTANY

BY THE DIRECTOR, DR. WILLIAM SAUNDERS, C.M.G.

FOR THE

YEAR ENDING MARCH 31 1909

OTTAWA GOVERNMENT PRINTING BUREAU 1910



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### REPORT

#### OF THE

# DIVISION OF ENTOMOLOGY AND BOTANY

#### BY THE DIRECTOR, DR. WILLIAM SAUNDERS, C.M.G.

It becomes my painful duty to record the death during the year of a beloved member of our staff, a most highly esteemed fellow worker, one whose urbanity and kindly spirit endeared him to all. I refer to the late Dr. James Fletcher, Entomologist and Botanist to the Dominion Experimental Farms, who died, after a brief illness, on November 8, 1908. He was born at Ashe, in the county of Kent, England, on March 28, 1852, was educated at King's School, Rochester, and came to Canada in 1874 to fill the position of a clerk in the Bank of British North America. After two years he gave up his position in the bank and became an assistant in the Library of Parliament at Ottawa. Here he devoted much of his spare time to the study of entomology and botany, and became, as years went on, a recognized authority in each of these branches of natural science.

Prior to the organization of the Experimental Farms, Dr. Fletcher acted as Honorary Dominion Entomologist to the Department of Agriculture, and in this capacity published two reports, the first in 1884, the second in 1885. These reports dealt chiefly with injurious insects and the remedies for their destruction.

On July 1, 1887, Dr. Fletcher was appointed Entomologist and Botanist to the Dominion Experimental Farms and was then transferred from the position he had occupied in the Library of Parliament to the staff of the Farms. He was thus enabled to devote himself entirely to natural history and his work became the great pleasure of his life. For twenty-one years the writer was intimately associated with Dr. Fletcher from day to day and watched the development of his work with much interest. In his capacity of Dominion Entomologist, Dr. Fletcher studied with great assiduity the many problems which presented themselves in reference to insect life, such as the life histories of many injurious insects which prey on the crops of the farmer and by their depredations often materially lessen his profits, as well as the life history and habits of the many parasitic species which feed on and destroy the farmer's enemies and thus render him substantial service. He also experimented with the remedies proposed for the destruction of the injurious species and thus tested their efficacy.

As Botanist, Dr. Fletcher studied the value as fodder plants of such species of grasses and clovers as can be grown successfully in the different parts of the Dominion. He ascertained their value for the production of hay and recommended the most promising of them for more general cultivation. These fodder plants were grown in

convenient plots at the Central Experimental Farm, where they could be shown to visitors and their points of excellence explained. He also studied the subjects of rust, smut and such other low forms of vegetable life as are injurious to our grain crops. Dr. Fletcher also devoted much attention to another class of enemies with which the farmer must wage war if he is to be successful in his work; I refer to the weeds which infest his crops. These, if allowed to multiply, crowd the useful plants he is growing, rob them of light and air and of the moisture they need, also of much of the fertilizing material in the soil which would otherwise contribute to their growth.

In both these divisions of Dr. Fletcher's work the field was practically unlimited, and in preparing his Annual Reports from the large mass of material available, the chief difficulty was to select the best and most useful.

Dr. Fletcher's first report after his appointment on the Farm staff, that for 1887, may be considered in its general usefulness and the variety of important topics discussed as typical of the series. This begins with an article on the insects injurious to cereal crops, in which those affecting wheat claim first attention, followed by those species which injure other valuable cereals. The species destructive to hay and clover are next considered, then the worst pests which affect field roots and potatoes. Those insects which are destructive to the apple crop were also dealt with, followed by those which injure the grape, raspberry, currant and strawberry. A chapter was also devoted to some of the worst insects affecting forest trees. In all these instances the most useful remedies for the destruction of these injurious species were dealt with.

The twenty-one Annual Reports which were written by Dr. Fletcher together with the excellent cuts with which the text was illustrated have been of great value to the farmers of Canada by instructing them how to recognize their insect enemies as well as their insect friends, and at the same time instructed them as to the most practical measures to adopt for the destruction of the more injurious species treated of.

He also waged a constant warfare against weeds, and his reports and bulletins containing instructions as to the best methods of destroying the different injurious species are highly appreciated and followed by many of the most intelligent farmers throughout the Dominion. Bulletin No. 28 of the Experimental Farm series on Weeds, was written by Dr. Fletcher, in which one hundred and sixty-four of the most troublesome weeds are mentioned and the best methods of destroying them. Dr. Fletcher also prepared that beautiful illustrated work on Farm Weeds of Canada published by the Seed Commissioner's Branch.

Bulletins on entomological and botanical subjects were prepared, either wholly or in part, by him, of which Nos. 3, 11, 14, 19, 23, 37, 43 and 46 are examples. His last bulletin was No. 52, Insects Injurious to Grain and Fodder Crops, Root Crops and Vegetables. From his busy pen there appeared also, from time to time, many communications to agricultural and other papers giving accounts of the occurrence of insect pests in various parts of the Dominion and the best methods to adopt for their destruction.

For many years past Dr. Fletcher was invited, from time to time, to give evidence before the Select Committee on Agriculture of the House of Commons. On these occasions he rendered most acceptable service by bringing under the notice of the committee details of some of the more important lines of work carried on by the Division of Entomology and Botany.

During the past twenty-one years Dr. Fletcher carried on a large correspondence with farmers in almost every part of the Dominion. He also attended farmers' meetings in all the different provinces, where, in his addresses, he conveyed, in a pleasant and forceful manner, much valuable information to his hearers.

In his position as Entomologist he was entrusted with the management of the federal fumigation stations where arrangements are made for fumigating 'trees, shrubs and other nursery stock under the San José Scale Act to prevent any further

introduction of that terrible pest. During the past two years Dr. Fletcher was also given the supervision of the spraying of orchards in the Indian reservations in British Columbia, to prevent their becoming distributing points for injurious insects.

In 1885 he was elected a Fellow of the Royal Society of Canada, in which he took an active part, in 1886 he became a Fellow of the Linnaan Society of London, Eng., and in 1896 he received the degree of LL.D., *Honoris causa*, from Queen's University.

Dr. Fletcher was kind and generous to all inquirers seeking information, especially to young students in entomology and botany, freely giving them much of his valuable time in helping and encouraging them in their work. His was a busy life, and the good work he has done will furnish a lasting memorial to his energy and industry which will live long in the memories of those who have profited by his instruction.

#### DIVISION OF ENTOMOLOGY AND BOTANY.

#### THE BROWN-TAIL MOTH IN SHIPMENTS OF NURSERY STOCK FROM FRANCE, 1909.

Early in January, 1909, the officers of the Bureau of Horticulture of the Department of Agriculture, Albany, New York, discovered nests of the living larvæ of the Brown-tail Moth in nursery and seedling stocks imported from France. Mr. Geo. G. Atwood, Chief of the Bureau of Horticulture, at once communicated this information to the Division of Entomology and Botany of the Dominion Experimental Farms, when the following circular was immediately prepared and sent to nurserymen and others likely to be interested in this matter throughout Canada. Copies were also furwarded to newspapers and the agricultural press.

#### CENTRAL EXPERIMENTAL FARM,

OTTAWA, January 19, 1909.

It has recently come to our knowledge through the kindness of Mr. G. G. Atwood, Ghief of the Bureau of Horticulture of the State of New York, that about 75 nests of the young caterpillars of the Brown-tail Moth have been found on apple, pear and cherry seedlings, and quince stocks, recently received in New York State from France. The nests contained living caterpillars in the usual winter form.

The infested stock so far as examined was packed in or near Angers, France, and it is probable that some of the larvæ of this terribly destructive insect may find their way into different parts of Canada and become established there unless the utmost care is taken to promptly destroy them.

This insect has already done incalculable damage to orchards and woodlands in some of the eastern States where many hundreds of thousands of dollars have been spent during the past ten years in the endeavour to exterminate them, with only partial success. The Brown-tail Moth has recently been found in considerable numbers in parts of Nova Scotia, where constant efforts are being made to destroy them. It will be a great calamity to our fruit industry were this pernicious insect to become established in our important fruit districts, since this would result in a heavy annual loss.

Kindly inform me if you have or will be importing from France this season any of the seedlings or stocks referred to, as in such case I shall be glad to advise you as to the precautions which should be taken to prevent this pest from becoming established in your nursery. In case you have facilities for fumigating nursery stock with hydrocyanic acid gas on your premises, it would be well to place all boxes of fruit seedlings and stock received in the fumigating chamber for a sufficient length of time to ensure the destruction of all insect life. In case no fumigating chamber is available the cuttings from such seedlings and stocks should be carefully burned.

I am mailing you with this a copy of the report of our late Entomologist, Dr. James Fletcher, for 1906, in which you will find good illustrations of the Brown-tail Moth in its different stages, including the winter nest of the young caterpillars, the full grown larva and the male and female moths, and on pages 222 to 227 the life history and habits of this destructive species are given.



5094—p. 40.



I would strongly urge upon you the great importance of prompt attention to this impending danger, and trust that you will heartily co-operate with the government in the carrying out of such precautionary measures as it may be necessary to establish to overcome the threatened invasion of this formidable foe.

Yours very truly,

#### WILLIAM SAUNDERS,

#### Director, Dominion Experimental Farms.

After undoubted nests of the Brown-tail Moth had been found in shipments of French nursery stock imported into Ontario, the following additional circular was\_sent to nurserymen and others:---

#### DIVISION OF ENTOMOLOGY,

#### CENTRAL EXPERIMENTAL FARM,

OTTAWA, February 5, 1909.

#### NURSERYMEN-ATTENTION!

#### The Brown-tail Moth.

In view of the fact that a number of the winter nests of the Brown-tail Moth, all of which contained living caterpillars, have recently been discovered, in Ontario, in nursery seedling stock imported from France, it is extremely important that all seedlings and stocks being brought in this season be carefully examined in a good light to see if this very injurious insect is present in shipments received. In New York State, 1,800 nests of the Brown-tail Moth have been found within the past few weeks in cases of stock imported from France. Nests have been found on apple, pear, plum, cherry, rose, quince, elm and Amelanchier.

As each winter nest of the Brown-tail Moth contains between two and three hundred small caterpillars, about one-quarter of an inch in length, it can be easily realized that the danger of this pest becoming introduced is very great. The nests are easily seen, being whitish in colour and situated between two or three twigs or along the main stem of the seedling.

We should feel obliged if every nurseryman who has this winter imported seedlings, or stocks, from abroad, would at once communicate with this Division, so that, if necessary, an inspector may be sent to examine the stock, and this is better done at the time the cases are opened.

The surest way to destroy the nests is to at once burn them as they are found. All packing material in infested boxes should also be most carefully burned, as well as the boxes, as there is danger of the small caterpillars having left the nests and sccreted themselves in the crevices of the cases. All trimmings from stocks should also be promptly burned.

In the New England States, hundreds of thousands of dollars have been spent in fighting the Brown-tail Moth. This insect was first introduced into Massachusetts about the year 1890, and it is said to have been brought in on rose bushes from Holland or France. It has now become very abundant and injurious.

It would be a great calamity if this dreaded pest established itself, in any locality, from stock imported this season from France. It is hoped, therefore, that all nurserymen will co-operate with the government in every way in their power to prevent the Brown-tail Moth from being thus introduced.

The Entomological Division will be glad to receive from nurserymen, or others, any communications on this subject, and to give any further information desired as to the life-history of this insect and the precautionary measures which should be adopted.

WILLIAM SAUNDERS, Director, Dominion Experimental Farms. ARTHUR GIBSON, Chief Assistant, Division of Entomology.

The nurserymen generally were keenly interested in this threatened invasion of such an injurious pest, and co-operated with the Division in every way in their power. They were thoroughly alive to the danger from such infested nursery stock, and were grateful for the prompt way in which the department had undertaken the work of inspection.

The thanks of the department are due to Mr. G. G. Atwood, Chief of the New York State Bureau of Horticulture, who was most helpful in advising us throughout the season of shipments of nursery stock coming into Canada through New York State. Most of the nurserymen, too, kept the Division well advised of any shipments they had received. As soon as advice of arrival of such stock was received, Mr. Arthur Gibson, Chief Assistant of the Division of Entomology and Botany, was at once sent to examine the same. In this work of inspection it was of course necessary to carefully examine all the material to see if any nests of the Brown-tail Moth were present. As a rule these nests are very conspicuous, but occasionally a very small nest, or one which had become broken, was found. To avoid the possibility of any of these escaping required great care.

The following list of the stock examined, and the number of nests of the Browntail Moth which were discovered, at each inspection, has been prepared by Mr. Gibson:—

-													
Da Exa ti	te of mina- on.	Nurseryman or Consignee.	Na	ture o	f Stoc	k.	Import	ted Fr	om.	Ńests Found.			
Jan	96 27	E D Smith Winona Ont.	150.000	fruit	seedli	110'S	Orleans	Franc	A	1	nest on nium		
"	20, 21	C. F. W. Carpenter, Win-	27,000	IL UI U	11		Angers	11 110		1	No nests found.		
н	28	A. G. Hull & Co., St.	12,000		"	•••			••••	1	nest on pear.		
"	29	Morris & Wellington, Font-	35,000		11		Orleans	н	• • • • •	14	nests, 13 on pear,		
Feb.	4	Trappist Fathers, La	2,000	000010	H ontals	3,200	Angers		• • • • •		No nests found.		
"	10-13	Brown Bros. Nurserymen Co., Brown's Nurseries, Ont	10,600	fruit s	" seedlin	86,000 1gs.	H	11		1	nest on plum.		
		J. E. McCombs, Pelham Corners, Ont.	13,000		u		11	`ŧŦ	• • • • •	4	nests, 3 on pear, 1 on apple.		
		B. W. Secord, Pelham Corners Ont	52,000		11	• •••	11	"	• • • • •	4	nests, 2 on pear, 2 on apple.		
		J. E. Crow, Ridgeville,	16,000		11	••••	11	н	••••	4	nests, 3 on pear,		
	- 15	J. Page, Ridgeville, Ont E. D. Smith Winona Ont.	18,000 150.000	fruit	u seedli		Orleans			$\frac{1}{20}$	nest on cherry.		
	20.22	Morris & Wellington Font-	3,000	ornan	nental	.S.	UTICALLS .			20	No pests found		
Man	20-22	hill, Ont.	6,985	ornan	nental	S.		11		9.4	nosts on apple		
11	3	C. F. W. Carpenter, Win-	14,000	manu	1		Angers	11	·····	8	"		
11	4	Morris & Wellington, Font-	· 600	ornan	nental	s	Orleans		••••		No nests found.		
"	17	Brown Bros. Nurserymen Co., Brown's Nurseries,	10,550	goose	berry	bushes	Hexham	, Engl	and		U		
11	<b>1</b> 9, 20	11 . 11	85,000 2,000	fruit ornan	seedli nental	ngs s.	Angers,	Franc	e	66	nests, 42 on pear, 21 on plum and 3 on guince		
11	22	E. D. Smith, Winona, Ont. G. W. Robinson & Co., Hamilton Ont	53,000 6,590	fruit assort	seedli ted ro	ngs ses,&c.	Orleans Boskoop	, Holla	and	17	nests on apple. No nests found.		
18	23	J. A. Simmers, Toronto, Ont.	6,950		11	••	н	, n	•••				

## REPORT OF THE DIVISION OF ENTOMOLOGY AND BOTANY

#### SESSIONAL PAPER No. 16

Date of Examina- tion.	Nurseryman or Consignee.	Nature of Stock.	Imported From.	Nests Found.
Mar. 29,30	W. O. Burgess, Queenston, Ont.	50,000 fruit seedlings (some birch).	• Angers, France	10 nests, 5 on plum, 3 on pear, 1 on apple and 1 on
ıı <b>3</b> 0, 31	Morris & Wellington, Font- hill, Ont.	60,865 asst.shrubs & trees 3,815 " " "	Orleans Alma Nurseries, Hol-	No nests found.
April 1	E. D. Smith, Winona, Ont.	24,800 asst. shrubs	Angers, France	5 nests, 1 on sugar maple 2 on rose
" 1-3	W. Rennie Co., Ltd., To-	29,490 "	Boskoop, Holland	No nests found.
" 5	G. M. Hill, Fruitland, Ont.	10,000 fruit seedlings 10,800 " and ornamental shrubs	Angers, France Orleans "	2 nests on pear. No nests found.
ıı 5,6	Steele, Briggs Seed Co., Ltd., Toronto, Ont.	2,300 gooseberry bushes 14,038 ornamental shrubs 1,300 gooseberry and currant bushes	Carlyle, England Boskoop, Holland Hexham, England	75 75 92
" 6	C. Macdonald, Toronto B. Brecken, Toronto	715ornamentalshrubs	Boskoop, Holland	**
" 7	Estate of John Stewart, Goderich, Ont.	6,200 fruit seedlings 500 ornamentals.	Orleans, France	17
0	Jos. Tweddle, Stoney Creek, Ont.	7,225 gooseberry bushes	Hexham, England	19
- н ' '8	ton, Ont.	10,710 assorted shrubs 24,843 "	Orleans, France Boskoop, Holland	**
"14 "16, 17	Graham Bros., Ottawa Canadian Nursery Co., Pointe Claire, Que.	575 "	н н. Н н.	и и
		20,000 fruit seedlings 250 ornamentals	France.	8 nests on pear. No nests found.
<b>11</b> 18	A. Roszel, Pelham Corners,	16,000 fruit seedlings	Angers, France	11 11
ıı 23	J. E. McCombs, Pelham Corners.	1,250 assorted shrubs		17
ıı 24	Steele, Briggs Seed Co., Ltd., Toronto.	12,360 ornamental shrubs and trees.	France	1 nest on Prunus pissardi.
u · 26	J. W. Smith & Sons, Vine- land, Ont.	20,000 fruit seedlings	11	No nests found.
н 27-28	Morris & Wellington, Font- hill.	24,000 " 5,250 assorted shrubs	Oudenbosch, Holland	97 93
# 28	J. E. McCombs, Pelham Corners.	2,250 ornamentals	France	99 16
	John Dobbie, Niagara Falls, Ont.	300 assorted roses	Hilligorn, Holland	"
11 29	J. Page, Kidgeville, Ont	a 500	Angers, France	3 nests, 1 on apple, 2 on pear.
may o	Corners, Ont. W. Baker & Son. Lon-	734 assorted roses.	Orleans "	No nests lound.
., 10	gueuil, Que. B. W. Secord. Pelham	25.000 fruit seedlings	Angers "	2 nests, 1 on pear
" 10, 11	Corners, Ont. Brown Bros. Nurserymen Co., Brown's Nurseries,	124,780 assorted trees and shrubs.	Ussy, Calvadoes, France.	and 1 on apple. No nests found.
<b>n</b> 12, 13	Ont. Pointe Claire Nurseries, Pointe Claire, Que.	9,050 "	Boskoop, Holland	н н
		11,850 assorted trees and shrubs.	Ussy, Calvadoes,	11
<b>n</b> 14	W. C. Reid, Belleville, Ont.	7,000 fruit seedlings 1,640 assorted shrubs	France.	. H H
<b>н 2</b> 6	W. J. Kerr, Ottawa	1,300 assorted shrubs	Leloire, France	**

From the foregoing statement it will be seen that, in the provinces of Ontario and Quebec, 1,503,129 plants were examined. The larger proportion of this stock was fruit seedlings—apple, pear, plum and cherry—either for grafting or budding. The total number of nests of the Brown-tail Moth found in the shipments made to the two provinces named, is 196, all on stock imported from France. Of this number, 188 were found in Ontario, and 8 in Quebec. These occurred as follows: 100 on pear, 56 on apple, 28 on plum, 5 on quince, 1 on cherry, 2 on rose, 2 on spiræa, 1 on sugar maple and 1 on Prunus pissardi. As each nest contains from 200 to 300 small caterpillars, it can be easily understood how the above provinces would probably have become badly infested by this extremely pernicious insect had these nests not been discovered and destroyed.

Shipments destined for other parts of Canada, of which advice was received, were at once reported to the provincial officers. Those for British Columbia were reported to Mr. Thos. Cunningham, Inspector of Fruit Pests, Vancouver, B.C., and those for Nova Scotia to Prof. M. Cumming, Secretary for Agriculture, Truro, N.S. Mr. Cunningham has advised us that nests of the Brown-tail Moth were found by his department on stock imported from France, but as yet we have no complete list of his findings. Mr. E. R. Clarke, of Annapolis, N.S., reported to the Division, that he had found one nest on stock which he had imported from France. Prof. Cumming stated, under date of June 14, that 'no Brown-tail Moth nests were discovered on imported stock officially examined this year in the province of Nova Scotia.'

At the outset of the above work, the Ontario Department of Agriculture was notified from time to time of the finding of the nests of the Brown-tail Moth in shipments of nursery stock from France coming into the province. Through the kind cooperation of Prof. C. C. James, Deputy Minister of Agriculture for Ontario, and Mr. P. W. Hodgetts, Director, Horticultural Branch, Mr. Harry Arnold, the San José Scale Inspector for the township of Pelham, was instructed to assist Mr. Gibson in examining some of the shipments received, chiefly those which came into the larger nurseries in the above township. Mr. Arnold is a very careful worker, and his valued help was very much appreciated. In a few instances owing to stress of other work at Ottawa, which prevented Mr. Gibson from covering the whole ground, Mr. Arnold examined several shipments alone. In these cases he reported that he had been most careful in looking over the consignments.

Mr. Gibson further reports: 'Every nurseryman or firm visited was asked to be most careful to see that all packing (such as moss and paper) was burned as soon as possible, also all cases in which stock had been received, particularly such in which nests had been found. It was also pointed out that in New York State the stock received in such cases was being dipped in a standard miscible oil, diluted with ten to twenty parts of water. This was shown by experiments to be sufficient to kill the caterpillars. As most of our nurserymen have not had any experience with these miscible oils, they were told that the ordinary well-known kerosene emulsion, diluted with nine parts of water, would probably answer the same purpose.'

'About the middle of January some of the nurserymen received shipments of fruit seedlings from France. These arrived during a particularly mild spell of weather and were at once heeled in, in the ground outside. When advice came from the Chief of the Bureau of Horticulture of New York State that nests of the Brown-tail Moth had been found in shipments from France, the ground in Ontario was frozen hard, so it was impossible then to remove the stock which had been heeled in, to examine it. Hence this work had to be done in spring as soon as the weather permitted. The stock examined on the 18th, 26th, 28th (Mr. J. E. McComb's) and 29th April, and on 3rd and 10th May, had all been heeled in, outside, with the exception of that of Mr. B. W. Secord's, which had been packed away in layers, with earth between, in a cool cellar.'

'From the careful way in which all shipments of nursery stock were examined, we have every reason to expect that every nest of the Brown-tail Moth present was

found. Nurserymen and others, however, should watch as far as possible this summer all imported stock which has been planted out, and if any strange looking caterpillars are noticed, send them at once to the Division of Entomology at Ottawa. It is important that this should be done, in case any stray caterpillars may have escaped. In certain instances where broken nests had been found, the great danger of leaving around any packing, of whatever kind, which had been in the case, was particularly pointed out. If such packing were not destroyed before spring, it can very easily be seen how some of these caterpillars might get out and establish themselves.'

In view of the widespread interest in the Brown-tail Moth in Canada at the present time, the following account of the insect has been compiled by Mr. Arthur Gibson, Chief Assistant, mainly from the report of the late Dr. Fletcher for 1906:----

#### INTRODUCTION AND SPREAD IN AMERICA.

The Brown-tail Moth was introduced into America about the year 1890, at Somerville, Mass. It is said to have been brought in on nursery stock imported from Holland or France. It was not until 1897, however, that it attracted particular attention, from its ravages upon pear trees. In Europe this insect has long been known as a pest of fruit and shade trees; it is spoken of there as the 'common caterpillar.' Since its introduction into Massachusetts it has spread into every New England State except Vermont. The following is reprinted from the report for 1906 of the late Entomologist and Botanist, Dr. James Fletcher:—

#### THE BROWN-TAIL MOTH IN CANADA.

'In 1902, Mr. William McIntosh, of St. John, New Brunswick, took a single male specimen of the Brown-tail Moth (*Euproctis chrysorrhæa*, L.) about 20 miles from St. John, N.B. About the same time another specimen was taken by Mr. Gordon Leavitt, at St. John; and in July of 1905, Mr. John Russell took a third specimen at Digby, Nova Scotia. Up to the present time these have-been the only authentic records of this much-to-be-dreaded insect having been taken in Canada. Recently, however, I have received from Mr. C. Perry Foote, of Lakeville, Nova Scotia, one of the winter nests of the Brown-tail Moth, filled with the living caterpillars, thus proving that this insect has established itself at one place at least in Canada.

'It was to be expected that the moths might be found here at any time, having been brought up direct from Massachusetts on one of the steamboats which ply regularly between Boston and the Maritime Provinces; but this would not necessarily prove that the insect had established itself. The occurrence of the young caterpillars, however, is a more serious matter, and shows that energetic measures are necessary at once to suppress and possibly to wipe out this unwelcome visitor before it becomes more widespread. The recognition of the winter nests is an easy matter, and this is the time of year to attend to their destruction. The Brown-tail Moth passes the winter as a very young caterpillar, and large numbers of these form colonies at the tips of the branches of the trees upon which they have been feeding the previous summer. The eggs are laid during July, and, on hatching, the caterpilars feed for some time on the upper surface of the leaves. As winter approaches, they crawl to the tip of a branch and bind together a few leaves so as to make a tent. This is securely closed up with silk, and the caterpillars remain dormant all through the winter and until the buds burst the following spring. These winter nests are easily recognized. from being almost invariably at the tips of the branches, and from being at this time of the year the only nests which contain colonies of living caterpillars. These latter are black, but covered with rusty hairs, and on the 10th and 11th segments towards the end of the body there are two very conspicuous, reddish-yellow, cushion-like tubercles, one on each segment, which the caterpillars can elevate or depress at pleasure.

#### A DANGEROUS ENEMY.

'With the exception of the San José Scale, there are no two insects which have attracted so much public attention, nor with regard to which so much money has been spent in America by the State and Federal Governments of the United States, as the Gypsy Moth and the Brown-tail Moth. Both of these are pests introduced into America from Europe—the Gypsy Moth about 1869, and the Brown-tail Moth somewhere about 1890. Millions of dollars have now been spent on fighting the Gypsy Moth and the Brown-tail Moth in Massachusetts and the adjoining States. Dr. Howard, when treating of this insect and of an effort which is being made to introduce European parasites says, in the Year-book of the Department of Agriculture for 1905: "The Brown-tail Moth has become even more abundant and injurious than the Gypsy Moth, and, owing to the fact that the female flies readily, whereas the female of the Gypsy Moth does not fly at all, the Brown-tail Moth has far exceeded the Gypsy Moth in its spread."

#### PLANTS INJURED.

'These caterpillars injure nearly all of the large and small fruits, and many perennial plants. The pear and apple seem to be favourites; but stone fruits, elms, maples and the oak are also commonly injured. A list of over 80 different kinds of food plants was published in 1903. Thousands of fruit trees in the vicinity of Boston, Dr. Howard says, have been killed by the Brown-tail Moth.

#### THE BROWN-TAIL RASH.

'Not only are the caterpillars of this insect voracious feeders upon the foliage of many kinds of trees, but they cause much annoyance from their stinging hairs, which cause excessive irritation when they come in contact with the human skin. Each hair is barbed, and at the time the coccons are spun these hairs are broken off and carried by the wind, when they fall on the neck and other exposed parts of the body, giving rise to a painful rash, which is very serious with some people, even although they may not have actually touched the caterpillars. Dr. Howard's assistants who have been working on this insect, have suffered very severely; and persons engaged in removing the nests from trees in the winter time must be careful not to handle these nests too freely, or they may be inconvenienced by this rash. The nests should be cut off from the trees, placed in a basket with as little handling as possible, and burnt at once. Dr. Howard states that "a large part of the popular feeling in New England that the Brown-tail Moth must be exterminated, is due as much to the annoyance of this rash as to the loss of vegetation from the caterpillars." As a remedy for this rash a free use of vaseline is recommended.

#### DESCRIPTION OF INSECT.

'The Brown-tail Moth resembles very closely the well-known Fall Webworm, being of a beautiful pure white, except the tip of the body, which in both sexes is brown, and from which the popular name is derived. The female bears at the tip of the body an almost globular tuft of brown hairs. Both sexes fly freely, and are much attracted to lights—a fact of some importance as affecting their spread. The search-lights of night-sailing passenger steamers have attracted so many as to have drawn the attention of the officers of such vessels, who reported that moths had alighted upon their ships in great numbers in the vicinity of Boston about midnight on several occasions, and the introduction of the species at more than one seaport in Maine is attributed by Dr. Howard to vessels coming from the infested districts rather than by natural spread by direct flight.

#### ONLY ONE BROOD IN THE YEAR.

'The eggs are laid in masses containing about 300 eggs. These masses are brown in colour from a thick covering of the golden brown hairs from the tip of the body of the female moth; and the whole egg mass more nearly resembles a silky, downy caterpillar than a cluster of eggs. These masses average about two-thirds of an inch in length by one-fourth of an inch in width, and are found on the lower surface of the leaves in July. The caterpillars hatch in August, but do not injure the trees much before winter. As soon as the buds burst in spring, they are at once attacked by the caterpillars, which emerge from their winter shelters and do much harm.

#### SUMMER TREATMENT.

'If the winter nests of the caterpillars have not been destroyed, trees should be sprayed with arsenical or other poisonous washes, so as to destroy the caterpillars during May and June. The caterpillars of the Brown-tail Moth are not so resistant to the poisonous effects of Paris green as are those of the Gypsy Moth. The spraying of all orchards with the poisoned Bordeaux mixture as a regular practice is recommended to all Canadian fruit-growers as the best general means of securing first-class fruit free of most of the ordinary pests which injure fruits. As the Brown-tail Moth caterpillars attack many other kinds of trees than fruit trees, it will be necessary that they should also be sprayed, and for this purpose Paris green may be used. A good useful poison wash consists of Paris green, 1 pound; fresh lime, 1 pound; water, 160 gallons. It is a very useful practice, however, among fruit-growers to use more than 1 pound of Paris green with lime in the 160 gallons, and, indeed, 2 pounds may be used without danger if 2 pounds of lime are added. Arsenate of lead is a newer remedy of great value, from the fact that it does not injure foliage so much, and remains on the leaves for a longer time. Three pounds of arsenate of lead may be used in 40 gallons of water without injury.

#### RÉSUMÉ.

'The Brown-tail Moth, which has been the cause of enormous loss in Europe and the United States, is undoubtedly established in one locality in Nova Scotia, and probably in several others. It is important to find out as soon as possible the range of infestation; and everybody is urged to send in as soon as possible any suspicious nests of insects, or clusters of leaves webbed together, particularly if they contain caterpillars, whenever any are noticed on their trees.

'The collection of the winter nests is the best and easiest means of controlling this insect.

'The collection of these nests must be done carefully, with as little handling as possible, and all should be burnt at once when cut from the trees.

'This work must be done before the buds burst.

'Any trees bearing nests of the Brown-tail Moth, after the buds have opened, must be sprayed with some poisonous mixture for the destruction of the caterpillars.

'The establishment of the Brown-tail Moth in Canada is a serious matter, affecting everybody in the district where the insects occur.

'What is now only a matter of considerable interest, may, if neglected, become a public calamity.

'Specimens for examination may be sent to the Entomologist, Central Experimental Farm, Ottawa. If so addressed, no postage will be required.

JAMES FLETCHER.'

Since 1906, the Nova Scotia Department of Agriculture has been most active in its endeavours to rid the province of this dreaded pest. The following letter gives concisely the present state of the Brown-tail Moth in that province.

Truro, N.S., June 14, 1909.—' During the year we have had reported to us as destroyed, after a very careful search, about 750 Brown-tail Moth nests, as compared with about 6,000 two years ago, and 4,000 last year. I should also add that this season's search was the most thorough which we have yet made. It would accordingly appear that unless something unforeseen happens, we are making some headway in fighting this pest. Practically all nests have been discovered between Middleton, Annapolis county, and Digby, Digby county, and the majority in the vicinity of Bear River, Digby county.—M. CUMMING, Secretary for Agriculture.'

In another letter, Prof. Cumming stated that he had received a number of nests from oak and other forest trees. For two years a bounty had been paid on every nest collected, but during the present year this was discontinued, and instead, as is stated by Prof. Cumming in a letter dated March 20: 'We have now got down to what might be termed house to house work, which is being done by graduates of our own college.'

Mr. Gibson deserves great credit for the hearty enthusiasm he has thrown into this work and for the patient and thorough examination he has made of an enormous amount of material.

#### EXPERIMENTS WITH HYDROCYANIC ACID GAS TO KILL THE LARVÆ OF THE BROWN-TAIL MOTH.

#### (By Arthur Gibson, Chief Assistant, Division of Entomology and Botany.)

In order to test the value of fumigation with hydrocyanic acid gas, to kill the caterpillars of the Brown-tail Moth, the following experiments were conducted:—

February 26, 1909.—Two nests on pear seedlings, which had been put in a large wide-mouthed glass jar, with cheese-cloth covering, were fumigated at the same strength as is used in the federal fumigation stations, viz.: 1 ounce of cyanide of potassium, 1 ounce of sulphuric acid and 3 ounces of water, to every 100 cubic feet of air space. The fumigation box which was used is 4 feet high, 4 feet wide and 8 feet long = 128 cubic feet. The amounts of chemicals used were 1<sup>‡</sup> ounces cyanide of potassium, 1<sup>‡</sup> ounces sulphuric acid and 3<sup>‡</sup> ounces of water. The nests were exposed to the gas for 45 minutes, and afterwards when opened and examined the larvæ were all found to be alive.

February 27.—Two different nests on pear fumigated. Chemicals used: 2 ounces of cyanide of potassium, 2 ounces of sulphuric acid and  $4\frac{1}{2}$  ounces of water, for the 128 cubic feet in box. Exposure 55 minutes; no larvæ killed.

March 2.—The two nests fumigated on February 27 were again submitted to the same strength, but the exposure was for 45 minutes. A few caterpillars had emerged from the nests and were on the outside of the same. Result: none killed.

March 12.—The same two nests were fumigated a third time. The strength was increased to  $2\frac{1}{2}$  ounces of cyanide of potassium;  $2\frac{1}{2}$  ounces of sulphuric acid and  $7\frac{1}{2}$ ounces of water to the 128 cubic feet of space. The exposure too, was lengthened to one hour. Many of the caterpillars had left the nests and were resting on the sides of the jar. One small parasite was found alive in the jar, just before the fumigation took place. This, of course, had not been affected by the two previous fumigations to which these nests were subjected. Result: thirty dead larvæ in the jar after the fumigation, which was about one-fourth of the number of living caterpillars which had occupied the nests.

March 15.—The remaining larvæ in the same two nests were fumigated a fourth time. The strength used was the same as on March 12, but the exposure was lengthened to two hours. Many of the caterpillars were active on the sides of the jar. Result: only twelve dead, although several others were apparently without much life.

March 16.—The balance of the larvæ in these two nests were fumigated a fifth time. The strength was the same as on March 12, but the exposure was lengthened to three hours. The larvæ were active in the jar before the fumigation. Result: 32 larvæ were found the following day to be dead, but the larger number were still alive.

March 18.—Two new nests on pear were fumigated at a strength of 3<sup>3</sup>/<sub>4</sub> ounces of cyanide of potassium, 3<sup>3</sup>/<sub>4</sub> ounces of sulphuric acid and 11<sup>1</sup>/<sub>4</sub> ounces of water to the 128 cubic feet of space. This is three times the strength used in the federal fumigation houses for the destruction of the San José Scale on stock imported into Canada under the San José Scale Act. These two nests had been kept in cold storage until the day previous, and on bringing them into a warm office the larvæ soon began to leave the nests, and by the time the fumigation took place, by far the larger number of the caterpillars had emerged. The fumigation lasted for one hour. Result: only 18 larvæ dead.

On March 19 it was discovered that the chamber was leaking somewhat. It was at once tightened with new felt.

March 22.—The larvæ from the two nests fumigated on March 18 were again submitted to the same strength, but the exposure was lengthened to two hours. Result: about 30 larvæ killed, the balance active.

March 29.—Other larvæ, not previously fumigated, but many of which had been out of the nests for a considerable time, were exposed to the same strength of gas, and length of time, as those fumigated on March 22. In this jar there were 55 living larvæ. At first it was thought that 50 of these had been killed, but a later examination showed that only 37 were dead and that the rest were reviving.

The above experiments, although not very extensive, go to show that fumigation with hydrocyanic acid gas evidently cannot be relied upon as a practical remedy for this insect when in its winter condition. At the above strengths, even when the fumigation chamber was tightened, only a very small percentage of larvæ which had left the nests were killed. It would certainly require considerably greater strength and much longer exposure to kill the larvæ when within the nests, and, owing to the tough, closely-woven nature of these nests, the outcome would be very doubtful.

The following notes on some of the more important injurious insects of the past year have been compiled by Mr. Arthur Gibson, Chief Assistant, mainly from memoranda gathered by the Division of Entomology and Botany prior to the decease of the late head of the Division, Dr. James Fletcher.

#### THE CHIEF INJURIOUS INSECTS OF 1908.

#### INSECTS INJURIOUS TO CEREAL AND OTHER FIELD CROPS.

#### (By Arthur Gibson, Chief Assistant.)

During the season of 1908 very few of the well-known insect enemies of grain crops were injuriously abundant.

THE HESSIAN FLY, Mayetiola destructor, Say.—From Manitoba a single report came to the Division of injury by this insect. The only occurrence in Ontario which came under our notice was of a rather important outbreak which occurred in some wheat fields near Ottawa. Plants were noticed to be infested about the end of May, and in some places the attack was quite serious. In fields where the soil was poor and where the unfavourable weather conditions had weakened the plants, probably as many as fifty per cent were infested by the Hessian Fly. In other fields where the soil was better, the plants were stronger and better able to withstand the unfavourable conditions of the season, and in these fields the loss from Hessian Fly would amount to about five per cent. From collected material, both sexes of the flies emerged on June

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20, 22 and 23. Prof. Bethune reports that this insect was present in 1908 in injurious numbers, affecting winter wheat, in the counties of Norfolk, Brant and Essex in the Niagara district. The postponement of the time of seeding of fall wheat, until towards the end of September, has proved to be an important preventive remedy. By that time the flies of the second brood will have emerged and be dead. Care should be taken, of course, to prepare the land as well as possible for the crop, and it will also be a good plan to sow strips of wheat in August, in periods of excessive abundance, which should be ploughed under before the middle of September to kill all the contained larvæ. Land in which infested wheat has been growing should be put into another crop the following year.

THE WHEAT JOINT WORM, Isosoma tritici, Fitch.—In some parts of western Ontario this insect was present in considerable numbers. One correspondent, Mr. 'Sydney Cooper, of Mull, Ont., reports as follows:—

'September 3, 1908. As requested, I send you the wheat plants injured by the Joint Worm. On further investigation I find that the country for miles around has the Joint Worm in the wheat. Our thresher is quite observant, and he says that he has not threshed one crop as yet which is free of it. He also states that in one instance, as the sun was shining on a bin of wheat, it had the appearance of moving, the insects were so thick.'

The adult insect is a true fly, with only two wings. It is very small, about onetenth of an inch long, jet black in colour, with pale legs. The females pierce the straw and lay from six to twelve eggs inside its tissues. These eggs hatch into very small, slender, footless grubs, of a pale yellow colour, which when mature are about one-eighth of an inch in length. As the young grubs grow they cause a distortion of the stems a little above the first or second joints from the roots. Most of the grubs pass the winter inside of the galls or swellings, but a few transform and appear as flies in late autumn.

The following recommendations are taken from Bulletin 52, by the late Dr. Fletcher:--

'There is apparently only one brood of the Joint Worms in Canada; and, as they pass the winter in the straw, for the most part so near to the ground that a large proportion of the larvæ are in the stubble left on the fields, they can be largely reduced in numbers by burning over the stubble or by ploughing it down deeply. The broken off hardened pieces of straw which become separated in threshing and cleaning should be carefully gathered and burnt. Sometimes no apparent galls are formed, merely slight swellings with a hard, thickened condition of the straws representing the galls. These portions break off in threshing, and many are carried through with the grain. Straw from an infested crop should be got out of the way, either by feeding or burning before the ensuing spring.'

A regular short rotation of crops, while reducing the number of bad weeds and preventing them from increasing, will also do much to reduce the numbers of the Joint Worms. All recorded occurrences of Joint Worms in Canada have been of short duration.

THE CHINCH BUG, Blissus leucopterus Say.—Occasional records in Canada of this very destructive insect have been made, but fortunately no serious outbreak has, as yet, occurred, within the Dominion. In September, 1908, specimens of an insect were sent to the Division from Mr. R. Benedict, of Crowland, Ont., with the statement that it had destroyed all the late oats in his district. The oats, he said, turned white just after they had headed out, and thousands of the insects were on the ground. When the specimens were examined, it was at once seen that they were the well-known Chinch Bug, which has caused millions of dollars of loss to crops in a single year in the United States. Writing further, under date of October 5, Mr. Benedict says: 'With regard to the Chinch Bug, I may say that the insects did practically no damage

except to the late oats, of which, owing to the late season, there was quite a large acreage. The damage was general over the county of Welland.'

Prof. F. M. Webster, of the Bureau of Entomology, Washington, D.C., who is one of the leading American economic entomologists, and a high authority on insects affecting cereals, writes, in the Annual Report of the Entomological Society of Ontario, for 1898: 'While the Chinch Bug, in all probability originally a neo-tropical species, has as you know, spread northward over a portion of the Dominion of Canada, and while it has not as yet been known to depredate upon your crops to any noticeable degree, yet it may do so in the future, in which case it may be expected to first make its presence known in your timothy meadows rather than in your grain fields, and quite likely will work considerable injury before it is recognized by your agriculturists.'

The Chinch Bug when mature is about one-fifth of an inch long. It is blackish in colour, with conspicuous white wing-covers. In the immature form, the young bugs are mostly red, but the colour varies in the different stages. The winter is passed in the adult state. In the United States the mature insects hibernate in clumps of grass, under pieces of board, loose bark, stones, &c., and in the first warm days of spring appear again, pair, and the females soon begin to lay their eggs, according to most writers, either about or below the surface of the ground, among the roots of grass or grain. Prof. Webster says: 'It is more than likely that this varies with the condition, as the eggs are not infrequently found above ground about the bases of the plants, and even upon the leaves, though I have never found them there, but have often found them under the sheaths of grasses.' The eggs hatch in from two to three weeks. In most areas in North America, where the Chinch Bug is destructive, there are at least two broods, but in northeastern Ohio, which is just across the lake from the Canadian border, Prof. Webster doubted the occurrence of a second brood of young.

The Chinch Bug feeds on a number of different plants. It is recorded as feeding on all kinds of grain, several of the native grasses, as well as on broom-corn, sorghum, chicken-corn, rice, &c. In the western portions of the United States the damage is done chiefly to wheat, barley, rye and corn.

The remedies recommended for this insect are the cleaning up of all refuse in autumn which might serve as hibernating quarters for the adults; the making of deep furrows around infested fields at the time the insects migrate in which they can be killed by an application of kerosene emulsion; and the spraying of the outer edges of the fields with the same material when the insects are leaving one crop to attack another. If this latter is done it will stop the invasion for the time being and give the farmer a chance to plough another deep furrow along the edge of the field to be protected. The Chinch Bug is treated of very fully by Prof. F. M. Webster, in Bulletin No. 15, new series, of the Bureau of Entomology, Washington, D.C.

THE GRAIN APHIS, Macrosiphum granaria Kirby, which caused considerable alarm in the northwestern provinces in 1907, owing to the supposition that it was the socalled 'Green Bug,' was in 1908 very prevalent in many parts of Ontario and Quebec. Towards the end of August reports of its presence in large numbers began to come in, the complaints referring to its attacks on wheat. In his report, as Entomologist and Botanist, on the insects of the year 1907, the late Dr. Fletcher says: 'Unfortunately for the Grain Aphis there is no practical remedy which can be applied in a wholesale manner, but Prof. F. M. Webster, who has devoted much attention to the insects which attack grain crops, has constantly drawn attention to the great advantage of practising good agricultural methods in working land, such as the adoption of a regular rotation of crops, so as to keep up the fertility of the soil, and advises that care should be taken to sow grain at the best time to secure a vigorous growth, which will enable the plants to withstand the attacks of the aphis sufficiently long to allow the natural parasites which always sooner or later appear, to increase,  $16-4\frac{1}{2}$ 

so that the numbers of the plant lice may be reduced before serious injury is done to the grain plants.'

In 1908 it was noticed, in many places, that towards the end of the season, the parasites were present in large numbers and were quickly reducing the colonies of the aphis, but some reports say that they did not appear soon enough to prevent some damage.

THE CLOVER-SEED MIDGE, Cecidomyia leguminicola Lint.—During the past season the Clover-seed Midge has done serious damage in districts in Ontario, where clover is grown for seed. Many complaints have been received from farmers of the presence of the small, legless, pink maggots in their clover seed at threshing time, and some anxiety has been felt as to whether these would mature, and affect the crop of next year. In the samples received at the Central Experimental Farm, all the maggots were dead and shrivelled up.

The life-history and habits of this insect are well known. There are two broods in the season, corresponding with the two crops of clover seed. The eggs are laid in the forming flower heads of the clover; when these eggs hatch, the maggots penetrate the seed pods and destroy the seed. When the larvæ are full grown, about the end of June, they leave the clover-heads and enter a short distance into the ground, to change to pupæ. The perfect insects, forming the second brood, emerge from the ground, just as soon as the second crop of clover is coming into flower, and the females at once begin to lay their eggs amongst the forming blossoms. These eggs soon hatch, and about the time the seed is ripe the maggots leave the clover and enter the ground to pass the winter, whence they emerge again the next spring, just at the time the clover comes into flower.

Experience has taught farmers that the practice of feeding off their clover fields with cattle and sheep, until the beginning or middle of June, or cutting it before the 20th of that month, is the only way to secure an autumn crop of seed; thus the maggots of this first brood are destroyed by the cattle eating them, or they dry up with the clover hay which has been cut before they were mature enough to leave the heads of clover and go into the ground to pupate and change to the perfect insect, which is a small midge. If the clover is left standing in the fields till the end of June, a sufficient time elapses for this latter process to take place, and the perfect flies emerge again just in time to lay their eggs in the opening flowers of the second crop. In this way the seed of the second crop is destroyed, as well as that of the first.

As mentioned above, in all the samples of clover seed received last autumn and during early winter, the maggots were already dead and dried up; consequently there would be no advantage in destroying, by burning, such material. At threshing time, however, if the living maggots are noticed, it would be a good practice to have all screenings swept up and burned.

THE HOP FLEA-BEETLE, *Psylliodes punctulata* Melsh. —This insect in 1908 again did extensive injury to the hop plants in the large yards in British Columbia. During the last three years it has been estimated that this small black flea-beetle has destroyed fully three-fourths of the hops grown in British Columbia.

The following letters from the correspondence received by the late Dr. Fletcher show how extensive this outbreak was in 1908, in the large hop yards of Sir Arthur Stepney, at Agassiz, B.C.:-

'Vancouver, B.C., April 23.—The flea-beetles since my last visit (to Agassiz) two weeks ago have appeared in large numbers, and are now destroying the shoots of vines which are some five or six inches high. They are also in considerable numbers in the poles. Mr. Wilson showed me your letter to him, advising the spray of whaleoil soap, one pound in ten gallons of water. Fortunately we had a considerable supply of this on hand, and I immediately tried the solution advised by you, with most gratifying results. Outside of kerosene it is the only thing we have found so far that

kills the beetle practically wholesale. I am much obliged, indeed, for your suggestion, as yesterday when I saw the results of our other experiments and the beetle covering such a large area, I was in despair. I think the remedy is just in time to save things. I have discovered that the beetles are not confined to the yard, having found a number in the wood adjoining and also on nettles and other plants nearby.—H. C. AKROYD.'

Mr. Akroyd was written to on May 9 as follows:—'I sincerely hope that the good effects of the whale-oil soap spraying continues. I am sorry I did not ask you to add to this wash 3 lbs. of arsenate of lead to each 40 gallons of wash. I cannot believe that this beetle is immune from the effects of that poison. I am really much interested in this experiment and am determined that we will control this beetle. The chief difficulty, I feel, is the occurrence of the beetle in the wood, which will mean frequent relays of the pest from that source. I believe the whale-oil soap will kill all the beetles it touches. The strength I advised of 1 lb. in 5 gallons of water (not 10 as you say in your letter), but if 1 in 10 answers so much the better, because it reduces both the cost and the risk of injury to the plants.—JAMES FLETCHER.'

'Vancouver, B.C., May 19.-At the present time the beetles have completely devastated the whole of our yard with the exception of some 20 acres which we are spraying daily. The spray suggested by you proves a great success, but it appears to us we are unable to keep pace with the beetles, for the vines are covered with new insects inside of 24 hours. We experimented in several ways with the whale-oil soap, but found your suggestion of 1 lb. to 5 gallons of water the best. We have not, however, found so far the arsenate of lead to be advantageous. We have been using it in the proportion of 1 lb. to 10 gallons of water. We have also been experimenting with a bucket of kerosene to 80 gallons of wash, but this also does not seem to have made any difference. The whale-oil soap we are using is made by the Royal Soap Company of this city, and guaranteed to be 80 per cent whale-oil. We have five sprayers-three of 45 gallons each and two of 90 gallons each-now in use on the yard, and we have been endeavouring to save a portion of the yard, which was badly damaged when we first commenced spraying. The only way I can see of saving the vard this year would have been by spraying with your solution every 24 hours when the shoots first appeared. Of course this would mean a very large outlay in horses and sprayers. Mr. Wilson has written me this morning stating that the Horst Company have abandoned all hope of any crop this year. I personally went over their yards about a week ago and found them practically devastated. I think I wrote you in my last letter that the beetle had completely eaten up all tomato plants in the district .--H. C. Akroyd.'

In a letter written early in July, Mr. Akroyd stated that the constant spraying of the vines with whale-oil soap and water had the effect of curling up the leaves and making them very brittle and tender. Spraying was tried with a slightly less proportion of the whale-oil soap than recommended, but it was found that with less strength it would not destroy the beetle. About the middle of July the beetles were reported to have gradually diminished in numbers and that very few were seen on the vines. Towards the end of the month the beetles had practically disappeared. In early September, Mr. Akroyd visited the hop yards, and reported that more beetles were then present but not in very large numbers. At that time coal-oil pans and tarred boards were being used to keep the beetle in check. The vines which were sprayed most extensively were reported by Mr. Akroyd, on September 4, to be bearing well, but the crop as a whole would be small.

Writing under date of May 28, Mr. Hulbert, of Sardis, B.C., reported that the Hop Flea-beetle was doing great damage in the hop yards in his district. He stated that he had been keeping his under control for several years by catching them on tarred sheets, which are placed under the vines, and as these are jarred lightly with a branch or light stick, the beetles fall off and adhere to the tar.

In a recent bulletin by Dr. F. H. Chittenden on this insect (Bulletin 66, part  $\nabla I$ ., Bureau of Entomology, Washington, D.C.), valuable information is given on its

habits in British Columbia, data for which have been furnished by Mr. H. J. Quayle, of Whittier, Cal., who made studies on the life-history of the flea-beetle in British Columbia in July last. The beetle is a general feeder and besides the hop, is known to feed on rhubarb, beet, cucumber, turnip, radish, cabbage, mustard, potato, and red and white clover, as well as a number of weeds. The eggs, larvæ and pupæ of the insect were found by Mr. Quayle at a depth of from three to six inches from the surface of the ground, and, it is stated by him, that the larvæ apparently feed on the roots of the hop as well as upon other plants growing in the yard. Dr. Chittenden says: 'The abundance of the beetles when they appear early in the season on young plants, their constant reappearance, and the constant new growth of the plants from day to day, make it difficult to apply direct remedies with more than temporary benefit. Where the hops are sprayed with kerosene emulsion or whale-oil soap for the hop aphis the numbers of the beetles are lessened. Among measures which give promise of value are the institution of clean methods of cultivation, including deep fall ploughing, treating hop poles in such manner as to prevent the beetles from hibernating in them, and clearing all remnants from fields so as to leave them as bare as possible to prevent the beetles from sheltering there in winter. Arsenate of lead, Paris green, kerosene emulsion, whale-oil soap and Bordeaux mixture should receive further tests, as should the employment of trap crops.' With regard to the trap crops, as the beetle is particularly fond of rhubarb, it is suggested in the above bulletin that this plant be grown between rows, e.g. in the vicinity of woods, as an attraction, or lure, for the beetles, it being believed that the beetles will concentrate on these plants and thus give the crops an opportunity to grow to a sufficient height and strength to be able to resist the ravages of the pest.'

#### INSECTS INJURIOUS TO ROOTS AND VEGETABLES.

These crops were affected to a considerable extent by insects during 1908. The season in most districts was a remarkable one, owing to the long continued drought. At Ottawa the months of June, July, August and September were particularly dry, the rainfall from the end of May till the beginning of October being only 6.80 inches. Roots and vegetables consequently suffered severely from this cause and from attacks of various insects. Wire-worms were prevalent in land which had been in sod and which had just been used for potatoes. The Striped Cucumber Beetle was reported as being destructive in western Ontario. The Turnip Flea Beetle was very trouble-some in many gardens. These small, very active, shining beetles did much harm to young turnips and were also very destructive to the first sowings of radishes. Root maggots were more abundant than in 1907. Plant lice were much in evidence during the season. Towards the end of the summer, Swede turnips, cabbages and cauliflowers were attacked in many districts by the Turnip and Cabbage Aphis. At Ottawa, early in October, celery plants were severely injured by plant lice and many rendered useless.

THE SMALL WHITE CABBAGE BUTTERFLY, *Pontia rapæ* L.—This well-known enemy of market gardeners has been much inquired about. Its injuries during the past season have been prevalent throughout Ontario, Quebec and New Brunswick. The velvety green caterpillars, are about an inch long, with a broken yellow line along each side, and an unbroken one down the middle of the back. At first they eat the outside leaves, but eventually bore right into the head of the cabbage. As soon as the first appearance of the caterpillars is noticed, the plants should be dusted with pyrethrum insect powder, 1 lb. in 4 lbs. of cheap flour, after the whole has been mixed together and kept in a tight jar for 24 hours. As this remedy is so simple and has been recommended so often the annual loss by this insect should not be allowed to take place.

CUTWORMS.—Early in the season, cutworms, as usual, were present in injurious numbers in many districts throughout the Dominion. Reports of serious injury by

these caterpillars came from British Columbia, but as no specimens were received, it was impossible to say with certainty what the species was which was at work.

'Peachland, B.C., May 28, 1908.—I have a lot of garden stuff this spring and the cutworms are devouring everything. Thousands of tomato and other plants have been cut. Where the land is kept cultivated and no other crops growing between the peach trees, they are climbing the trees.—H. W. CRAWLEY.'

'Peachland, B.C., June 20.—The cutworms here have caused a loss of thousands of dollars in seeds and plants and labour, not counting the loss of the season's crops of such things as tomatoes, cucumbers, melons, &c. Young fruit trees have suffered; rhubarb, onions, strawberries, in fact everything is attacked by them.—H. W. CRAWLEY.'

In Ontario the Dark-sided Cutworm, *Paragrotis messoria* Harr. and the Redbacked Cutworm, *P. ochrogaster* Gn. were responsible for most of the damage. The Greasy Cutworm, *Agrotis ypsilon* Rott. was locally injurious in fields of corn, as was also the Glassy Cutworm, *Hadena devastatrix* Brace.

The most effective remedy against cutworms is the poisoned bran which has lately come into such wide use. This is made by mixing half a pound of Paris green with fifty pounds of slightly moistened bran. In making this it is best first to dampen some of the bran slightly with water containing a little sugar or molasses. After mixing thoroughly, add the Paris green by dusting it on the surface and stirring all the time. Half a pound of Paris green is enough to poison fifty pounds of bran, although double this amount may be used. If the mixture is too wet, more bran should be stirred in until the mixture will crumble easily and run through the fingers without adhering. When required for garden use, all that is necessary is to sprinkle a little of the mixture by hand around such plants as are liable to attack. When crops are planted in drills or in rows, a convenient way is to make the mixture rather dry, and then distribute it by means of a Planet Jr. or other wheel seeder. In field practice, among such close growing crops as standing grain, the poisoned bran is also The mixture can be distributed by means of a paddle or shingle, and serviceable. can be thrown easily to a distance of 20 feet. When distributed in this way, there is much less danger of chickens and birds picking it up than if it is placed in lumps. Strange to say, the cutworms will devour the poisoned bran in preference to the growing plants.

THE APPLE LEAF-HOPPER, Empoasca mali LeB.—In eastern Ontario and Quebec, the ravages of the Apple Leaf-hopper, to potatoes, beans and many other kinds of plants, were very serious; in fact, this outbreak was one of the most important of the year. This insect, which is very small, slender, pale greenish, about one-eighth of an inch long when mature, is closely allied to the Thrip, which commonly attacks the Virginian Creeper and causes the leaves to dry up and fall about the beginning of August.

The Apple Leaf-hopper began to make its presence apparent towards the end of June, by causing the leaves of the attacked plants to curl up and turn brown. The injury is done by thousands of these small insects, sucking the juices from the leaves and stems of the plant, which very soon blackens and fades. Some correspondents have thought that the injury to potatoes was due to the ravages of the well-known Potato Blight, a fungous disease, and have been surprised that the standard remedy for that disease, viz.: spraying the foliage with Bordeaux mixture, had not had the desired effect of stopping the injury. The young leaf-hoppers do not get their wings for some time after they hatch from the egg. It is during this stage that most of the harm is done, and this is the only time when a remedy can be applied with much success. As they are sucking insects, something which will kill by merely coming into contact with their bodies must be used, such as whale-oil soap, one pound in five gallons of water, or the ordinary kerosene emulsion. Potatoes which were sprayed with both of these mixtures early in July, before the young leaf-hoppers had acquired

their wings, were freed from the pest and not since injured to any appreciable extent. As these insects feed on the lower side of the leaves, it is necessary, in order to reach them with a spray, to attach the nozzle to a short joint of pipe about a foot long, having an angle of about 45 degrees in it. This can be made by any blacksmith. The severity of the outbreak of this insect in 1908, was doubtless much aggravated by the exceptional drought and heat which weakened the plants and made them more than usually susceptible to injury by the Apple Leaf-hopper and other insects.

The following letters will give some idea of the extent of the injury done by the Apple Leaf-hopper.

'Aultsville, Ont., July 30, 1908.—The potato crop in this vicinity is attacked by a very small green fly, which is present in enormous numbers and doing much damage. They appear to work under the leaf, with the result that the leaves curl up and finally die.—JOHN H. CROIL'

'Almonte, Ont., July 30.—I send a sample of some of our potato tops. Is it a blight, or is it a trouble caused by the extreme heat? The trouble appears to effect the older leaves first in most cases, as there will be more or less appearance of it near the base of the stalk while the top is very thrifty and green.—J. K. DARLING.'

The potato tops were carefully examined on arrival, and they showed the injury caused by the Apple Leaf-hopper.

'Ottawa, Ont., July 30.—A little green fly is killing our scarlet runner beans. Please tell me what will destroy it.—A. R. RALPH.'

'Perth, Ont., August 1.—The potatoes in this vicinity are badly infested with a small green insect. We should like to get some information concerning this pest.— R. S. HAMER.'

'Lakefield, Ont., August 31.—I am writing in reference to the widespread failure of the potato crop in our county—Peterborough. The weather has been favourable, though rather dry in August. The potato beetle has been kept in check, and in some cases plants have been sprayed with Bordeaux mixture, but the tops have withered and the tubers are small. On a visit to Bobcaygeon, I found the same conditions there, One grower here says that the plants have been destroyed by little green bugs. —A. W. MACKENZIE.'

Reports of great damage to potatoes and other vegetables were received from other points in Ontario and Quebec. Mr. Harold Jones, of Maitland, Ont., called at the Division on August 22, and reported that the leaf-hopper was very bad on potatoes in his district. He gave an instance of where nine potatoes only were gathered from nine hills. The presence of this insect in injurious numbers was also reported from northern points in New York State.

THE DESTRUCTIVE PEA APHIS, Nectarophora pisi, Kalt.—Early in August reports were received from correspondents in Ontario and Quebec of serious injury to the pea crop by a large green aphis, which suddenly appeared in enormous numbers. From specimens received, and from an investigation in the Ottawa district, it was soon seen that the insect at work was the destructive Pea Aphis. This plant-louse is pale green, with legs darkened, particularly at the joints, and has long honey tubes. It clusters in enormous numbers at the tips of the shoots, beneath the leaves, and, when very numerous, spreads over the whole plants of field peas, as well as upon the flowering Sweet Peas. These insects, as already mentioned, appear suddenly in large numbers, and very soon kill the plants by sucking their sap. The winged specimens are rather large for plant lice, being about one-eighth of an inch in length, with a wing expanse of nearly one-quarter of an inch.

'Lysander, Que., August 7, 1908.—I send specimens of a pale green insect which are covering my field peas. The plants are turning red and are withering up.— T. W. LONGMOOR.'

'Bedford Park, Ont., August 3.—A green insect has appeared on the pea crop in this neighbourhood. Some of the farmers are weeping and wailing because they

'Vars, Ont., August 5.—I am sending you a portion of a pea vine which is infested with a small green insect. This insect is playing havoc with the pea crop in some sections. My peas are being destroyed by this insect and some of the neighbours' peas are also affected.—D. N. JOHNSTONE.'

'Plainville, Ont., August 6.—Please find inclosed a specimen of louse that is attacking peas to such an extent that many fields will be scarcely worth harvesting. Will you have the kindness to give their history? Are they likely to continue for a number of years, and will it be safe to sow peas next year? While playing havoc with later peas, they did not attack the early peas.—W. J. WESTINGTON, President, Farmers' Institute.'

In reply to the above, Mr. Westington was informed that the Destructive Pea Aphis was this year being attacked by several important parasites, and owing to this, the injury was being stopped. As to whether it will be safe to sow peas again next year, it was pointed out that this would depend upon the amount of destruction wrought, generally, on the plant lice by the parasites during the autumn. In the last outbreak, in 1889 and 1900, the attack lasted for two years, but it stopped suddenly, just as it began, and in 1901, not a specimen of the insect was seen.

'Freeman, Ont., August 10.—You will be interested in knowing that we have an outbreak of aphis in the pea fields about here. In most cases the little green lice are so plentiful that no portion of the crop is spared.—Geo. E. FISHER.'

'Shawville, Que., August 31.—I have a large field of peas which has been destroyed by a large green louse. They do not eat the leaf, but suck all the substance out of the vines, and the plants dry up. The peas were a pretty heavy crop. Would like to know what this insect is and the cure, as my crop is a total failure. My neighbour's peas are also affected.—ANDREW SLY.'

In the Ottawa district the Destructive Pea Aphis was particularly noticed on Sweet Peas in gardens. From observations made after the middle of August, it was noticed that several kinds of parasites were busily at work, and that the plant-lice were thus being reduced rapidly in numbers. Lady-bird beetles and syrphus-flies were doing the larger share of this good work, but two other kinds of parasites which had never before been reared in the Division were present in considerable numbers. One of these belongs to the Cecidomyid genus *Aphidoletes*, the members of which are well known on account of their habits of preying upon aphids. The other was a small four-winged hymenopterous fly which proved to be an undescribed species, and which has since been described (Canadian Entomologist, March, 1909) as *Megorismus fletcheri* of Crawford.

Remedies.—In the report of the Entomologist and Botanist for 1899, the late Dr. Fletcher wrote as follows:—'When an insect appears in such large numbers as the Destructive Pea Aphis did during the past season, and increases with such rapidity, it is evident that it would be impossible to apply any remedy over such a large acreage as was simultaneously attacked, in most places where the insect occurs; but upon green peas and the flowering Sweet Peas in garden, the ordinary remedies used against other plant lice were found to be quite effective against this one also. Upon the Central Experimental Farm the Horticulturist had the plants sprayed with a tobacco and soap wash made of ten pounds of tobacco leaves in half a barrel of water, the liquid from which was strained off after a few hours, and two pounds of whaleoil soap were added. When the soap was all dissolved water was added to make forty gallons, and the liquid was then applied with a spraying pump. Most of the plant lice were found to be dead two days afterwards, and on such parts of the rows as received two applications, the vines were quite cleared of the insects.'

In his report for 1901, in speaking of the work of the late Prof. Johnson, he says: 'Many remedies were experimented with by Prof. Johnson, and it was found

that what he has called the "brush and cultivator method" was the most effective remedy. For this it is necessary that the peas should be planted in rows, and when the insects are noticed the vines are brushed backward and forward with a good pine switch, in front of an Iron Age cultivator, drawn by a single horse. In this manner the plant lice which leave the vines quickly when these are shaken were covered up as soon as they fell to the ground, and a large proportion of them destroyed. The operation was not repeated until the third day, as it usually required over 48 hours to destroy the insects when covered with earth. All the practical methods were tried, and it was found that the brush and cultivator method was the most effective: Another method which was tried with considerable success, consisted of a brush which dislodged the insects so that they fell into a pan containing coal oil and water drawn between the rows of peas. In this way a bushel of plant lice were caught to each row of peas 125 rods long. Spraying was tested by a thorough trial upon 100 acres, and all sorts of insecticides for sucking insects were used, but this method was abandoned because no spray could be found which would destroy a large enough percentage of the insects to warrant the expense of the operation.'

ROOT MAGGOTS.—These troublesome insects were much inquired about during 1908. From almost every province in the Dominion the complaints refer particularly to ravages to onions. In many instances, whole fields of onions were destroyed. In British Columbia the maggots were still at work when the onions were taken up in autumn. Cabbages, cauliflowers and radishes were also much injured.

As these insects are so often inquired about, it has been thought wise to repeat here what the late Dr. Fletcher says in his Bulletin No. 52 of the Dominion Experimental Farms series.

'The Cabbage or Radish Maggot, and the Onion Maggot, which for all practical purposes may be treated of here as the same species, cause great loss in crops of cauliflowers, early cabbages, turnips, radishes and onions, almost every season.

'The maggots which are found attacking cabbages, radishes, cauliflowers and turnips, and those in onions, and in beans and corn, are very similar, but they belong to three different species, *Phorbia brassicæ*, Bouché, attacking plants of the cabbage family, *Phorbia ceparum*, Meig., infesting onions, and *Phorbia fusciceps*, Zett., injuring beans and corn.

<sup>6</sup> Corn sown during a cold, wet period by which germination is unduly delayed, is very liable to be attacked by the Corn-seed Maggot (*P. fusciceps*). In such cases it is well to wait for warm weather to re-sow and then push on the crop with a light dressing of nitrate of soda, 200 lbs. to the acre.

'The perfect flies of all these maggots are very similar to the ordinary observer and may be described as slender flies, somewhat smaller than the ordinary house fly, which fly about close to the ground and lay their white eggs on the stems of the young plants. Here after a few days the maggots hatch and work their way down beneath the soil, where they lie close to the root or burrow into it, tearing the tissues with their hooklike mandibles and living on the sap, thus soon reducing the root or stem to a rotten mass. When full grown these maggots turn to reddish brown puparia in the soil close to the roots. The exact number of broods of these maggots which may be found in a season seems to be rather complicated by the overlapping of broods, and the delay in issuing of some individuals of each brood; but practically it may be said that cabbage and radish maggots do by far the greatest amount of harm during the month of June, and early in July, and in many years their injuries are slight after that period. With onions the injury continues throughout the season and is most noticeable in June, August and September. The injury to beans and Indian corn is only in spring, and, as a rule, is confined to plants which have been weakened by the seeds being planted too deeply or by late frosts. However, in seasons of excessive abundance cabbage and onion maggots may be found all through the growing season, and cabbages and cauli-

flowers are occasionally injured in autumn by the maggots attacking the heads of the plants.

'Remedies.—Up to the present time it cannot be claimed that any perfectly effichoicous remedy has been discovered for root maggots. In certain years they seem to be so extremely abundant that even the best remedies merely seem to prolong the lives of the plants, and only a very small proportion of a crop can be saved. In ordinary years, however, much can be done to protect crops liable to attack, and the following are the remedies which have given the best results:—

'For Onions.—White hellebore dusted along the rows once a week from the time the young plants appeared above the ground gave comparatively clean onions, very few being attacked. Fresh gas lime broadcasted over onion fields at the rate of two hundredweight to the acre had a similar effect; but, where the caustic lime came in contact with the young onions, they were burnt out. A light dressing, between the rows of onions, of the same material gave almost as good results as where it was distributed over the whole field. When onions have begun to form their bulbs, the earth may be hoed or brushed away right down to the roots, and in some years the maggots do not penetrate the bulbs. As soon as the earth is hoed away in garden practice, a dusting along the rows with white hellebore makes the protection more complete.

'Dressings of salt, Paris green and plaster and wood ashes have been found useless in protecting onions from the attacks of root maggots.

'For Cabbages.—(1.) Tarred Paper Disks.—Pieces of ordinary tarred paper three inches in diameter, with a slit running to the centre so as to allow of their being placed around the stems of young cabbages and cauliflowers at the time of planting, and pressed down close to the ground, will prevent to a large measure the flies from laying their eggs on plants so protected, or will kill the young maggots.

'(2.) Insect Powder.—About half a teacupful of a decoction of pyrethum insect powder (four ounces to a gallon of water), or of white hellebore of the same strength poured around the root of each plant, after drawing away the earth right down to the root, will destroy any maggots which may have started to work. The earth should be put back again and the plants well hilled up, when new rootlets will soon be formed. A light sprinkling of nitrate of soda or some special fertilizer will encourage a quick growth and much help the plants to overcome attack. Dressings of one ounce to the square yard may be used for this purpose. Cabbage plants should be examined late in June to see if the maggots are at work. The earlier the treatment with insect powder or white hellebore is applied the more effective it will be. If the mixture is applied to the roots with a force pump, although more liquid is consumed, it has the advantage of dislodging many of the maggots so that their injuries cease at once.'

'(3.) Cheese-cloth inclosures.—A very effective and practical means of procuring early radishes, cabbages and cauliflowers, perfectly free from root maggots, is by growing them beneath cheap frames made of light wood covered with cheese-cloth. A convenient size for small beds is 8 feet long, 2 feet wide and 2 feet high. This frame can be made for about 25 cents, of one and a half inch square wood, nailed together at the corners, and with the cheese-cloth tacked on the outside. In such a frame five cauliflowers and two rows of radishes have been grown to perfection. The frame was kept on from the time the young plants came up until the radishes were pulled.

Cauliflowers were sufficiently advanced to require no further protection and the frames were removed about the first of August.

'For Radishes.—The maggot which attacks the radish is the same species as also attacks cabbages and turnips, the severity of attack on these different crops being about in the order in which they are named, so that in years of light attack radishes will draw off injury from the cabbages.

'Injuries to turnips are seldom severe, and in most instances a crop shows little sign of this attack in autumn, even in seasons when the maggots may have been found in considerable numbers in the spring.

<sup>(1.)</sup> The Cook carbolic wash, consisting of one quart of soft soap, or one pound of hard soap, in a gallon of water, with half a pint of crude carbolic acid added, and the whole boiled together for a few minutes, to make the stock emulsion, has proved over and over again an excellent remedy for radish maggots. The stock emulsion can be kept in a closed vessel, so that dust and rubbish will not fall into it, and, when required for use, one part of this mixture by measure is added to fifty of water, and should be sprayed directly upon the growing plants from the time they appear above the ground, once a week until ready for the table.

(2.) White hellebore dusted along the rows of radishes once a week from the time they appear above the ground, has given good results in most years.

For Beans and Corn.—Injury to these crops in Canada is a rare occurrence. The only remedy which can be suggested, is to sow these crops in good season in well prepared soil and not deeper than one or two inches.'

During 1908, some experiments were conducted at the Central Experimental Farm with several mixtures in the hope of obtaining something more definite in the way of a practical remedy. The most encouraging results were obtained from a use of sulphate of iron, two ounces to every gallon of water, applications made a week apart from the time the onions appeared above ground.

#### INSECTS INJURIOUS TO FRUITS.

Among the insects which have been most destcurtive to fruits during 1908, the following may be mentioned:—

THE APPLE MACGOT, Rhagoletes pomonella Walsh.—This insect continues to be prevalent in certain districts in Ontario and Quebec. During 1908, it was again present in injurious numbers at Como and one or two other points in Quebec province. In Ontario, in Prince Edward county, it was much inquired about and did serious damage in some orchards. Fortunately, when the Apple Maggot once gets into an orchard its spread is very slow. The mature flies apparently do not fly away to any distance for the purpose of egg-laying, but confine their attention to the trees nearest to the place from which they emerged. The female fly lays her eggs in the flesh of the apple, by means of her sharp ovipositor. A single female may lay from 300 to 400 eggs, according to Quaintance. The eggs hatch within a week, and the maggots become full-grown in from a month to six weeks. The maggot leaves the apple after this has fallen to the ground and enters the earth just below the surface, where it remains in the pupal stage until the following summer, when the fly emerges. As the larvæ do not leave the fruit until this has fallen to the ground, all windfalls should either be carefully gathered by hand or a herd of pigs should be allowed to run in the orchard from July, when early apples which are specially susceptible to attack begin to fall, until all fruit is gathered. Cattle and sheep are also useful for such a purpose, and if allowed to pasture in the orchard, for a while, when the fruit is falling, much good will be accomplished. If the windfalls are gathered and there is no stock to feed them to, they should be buried in a deep hole with not less than three feet of earth on the top. As the larvæ of the Apple Maggot work entirely within the apple, it cannot be reached by any of the poison sprays such as are used for insects which feed on foliage.

THE CODLING MOTH, Carpocapsa pomonella L.—This insect was again reported as being very destructive in many districts in Ontario and Quebec. Its injuries were most apparent of course in unsprayed orchards. Growers who had regularly sprayed their trees with the poisoned Bordeaux mixture were well repaid for their labours.

#### REPORT OF THE DIVISION OF ENTOMOLOGY AND BOTANY

#### SESSIONAL PAPER No. 16

In Canada, east of Toronto, where there is usually only one annual brood, thorough spraying with the above mixture, three or four times in spring, the first application to be made within a day or two after the blossoms fall, and the subsequent sprayings, each ten days apart, is a satisfactory and well-paying remedy for the Codling Moth. West of Toronto there are two broods, the second of which is the more destructive. It has been found that in addition to the spring spraying, as above mentioned, it is there necessary to band the trees with burlap, sacking, or some other material which will form a refuge in which the caterpillars will spin their coccons. These bands should be removed at short intervals of a week or ten days, after about the middle of July, at which time the caterpillars begin to spin their coccons. The caterpillars within the coccons found may be destroyed by passing the bandages through a clotheswringer carried on a wheelbarrow. The bark beneath the band should be scraped with a wire brush to kill any of the caterpillars which may have burrowed into the bark.

The value of banding the trees has been demonstrated by many writers. In 1908, a small experiment was conducted in an apple orchard close to Ottawa, a part of which showed infestation by the Codling Moth. Twenty trees were banded on August 15. The bands were removed and examined on the following dates, with the results as mentioned:—

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The windfalls under these trees were left undisturbed until after the experiment ended.

THE WHITE-MARKED TUSSOCK MOTH, Hemerocampa leucostigma S. & A. and the RUSTY TUSSOCK MOTH, Notolophus antiqua L.-A large number of inquiries were received from the Maritime Provinces, chiefly from Nova Scotia, regarding these insects. In most cases the letters were accompanied by the egg masses. Both of these species, particularly the former, have been abundant in orchards in the above provinces for the last few years, and have in some instances been the cause of considerable injury. The White-marked Tussock Moth is the more injurious and the better known of the two, chiefly from its injuries to ornamental trees. In Montreal, Toronto, Kingston and other Canadian cities it has attracted much attention from its attacks to shade trees, many being entirely denuded of their foliage by the caterpillars. These insects were treated of at some length in the late Dr. Fletcher's report for the year ending March 31, 1908. The egg masses of these two Tussock Moths are quite different in appearance. Those of the White-marked Tussock Moth are laid on or close to the cocoon from which the female moth emerged and are covered with a frothy white deposit, so that they cannot be seen without breaking up the mass. The eggs of the Rusty Tussock Moth having no such frothy covering, are bare and easily distinguishable.

The remedies for these insects are the collection of the egg masses before spring and the spraying of the trees with an arsenical poison as soon as the young caterpillars are noticed. Orchards that are regularly sprayed with the poisoned Bordeaux mixture will be kept free from the attacks of these and many other leafeating insects. CANKERWORMS.—In 1908, Cankerworms did serious damage in many of the orchards in the Maritime Provinces. From Nova Scotia, particularly, many complaints were received of the prevalence of these insects, correspondents claiming that the injury had been very severe in many districts.

There are two kinds of caterpillars which attack apple trees, which are known as Cankerworms, viz., the Spring Cankerworm and the Autumn Cankerworm. The female moths of both kinds are wingless and have a very spider-like appearance. Those of the Spring Cankerworm appear chiefly in spring and lay oval, pearly-white eggs, in itregular masses, beneath flakes of bark, &c. The moths of the Autumn Cankerworm, on the other hand, appear late in the season (October and November), and the females lay eggs which are brown, flattened at the top, like miniature tumblers with caps on them, and stand close together in clusters of about 100 or more on the outside of the bark. The males are delicate moths, with gauzy wings. The caterpillars of both species are slender brown, blackish, or green loopers, or 'measuring worms,' about an inch in length when full grown, and with only six pairs of legs, three pairs of which are on the front part of the body, the other three pairs at the rear.

The young caterpillars appear about the time that the leafbuds open, and at that time the trees should be carefully examined, and, if any are found, the trees should at once be sprayed with an arsenical poison. When the caterpillars are small they are very easily killed by the ordinary poisoned Bordeaux mixture, or by Paris green 1 pound in 150 gallons of water, or arsenate of lead 3 pounds in 40 gallons of water. When they are more than half an inch long, however, they are very difficult to kill with any such poisons. At such times, Dr. Fletcher recommended as much as one pound of Paris green in 100 gallons of Bordeaux mixture, and that this latter should be made with five pounds of lime to the four pounds of copper sulphate in the 40 gallons of water.

As the female moths crawl up from the ground to deposit their eggs on the trees. all trees in orchards where the Cankerworms have been destructive should be banded in autumn and spring with one of the mechanical tree protectors, or the moths may be prevented from climbing by being caught on bands of thick paper which have been painted with an adhesive mixture, and tacked closely and firmly around the tree. A mixture of castor oil two pounds and resin three pounds has been found satisfactory for cold weather, but in hot weather it is necessary to add one more pound of resin. These ingredients are heated slowly until the resin is all melted and the mixture is then applied to the bands while it is warm. Another formula is five pounds of resin and three pounds of castor oil for warm weather and equal parts by weight for cold weather. As mentioned above, the most convenient way to apply these mixtures is to paint them on bands of thick paper, but they may be applied to the tree without injury to the latter. If this is done it is sometimes necessary to put on a second coating if too much of the oil is absorbed by the bark. Printers' ink five pounds, mixed with one gallon of fish oil, is also much used in Nova Scotia, and the amount mentioned will treat an acre of orchard.

The Chemical Division of the Dominion Experimental Farms recently carried on some experiments in the hope of finding a more economical adhesive material which could be used for such insects. Considerable progress was made, but the Chemist, Mr. Shutt, has informed us that this work is not yet far enough advanced to make a report upon. It is hoped, however, that when further experiments have been conducted, some useful deductions may be made.

THE PEAR LEAF BLISTER MITE, *Eriophyes pyri* Nalepa.—This old enemy of the pear is steadily spreading in the apple-growing districts of the southern portions of Ontario. It occurs in every part of Canada where the pear is grown, but it is only of late years that it has turned its attention to the apple, although in Europe it is well known to attack that tree. During 1908, it was much complained of, and information asked as to the best known remedy for its destruction.

The Pear-Leaf Blister Mite, as its name implies, is not on insect, but a mite. It is a microscopic creature, being only about  $\frac{1}{125}$  of an inch in length. Regarding the life habits of these mites, Prof. Parrott, of the New York Agricultural Experiment Station, says: 'The mites spend the winter in the buds usually under the second and third layers of bud-scales. They frequently collect in colonies of fifty or more in little depressions in the scales and are more or less concealed and protected by the pubescence of the buds. As the buds burst, the mites move to the unfolding leaves in which they burrow and establish new colonies. In October the mites abandon the leaves and hide in the buds.'

The irritation caused by the mites burrowing into the leaves from below, induces the growth of galls, or blisters. Within the blisters the eggs are laid; these hatch in a few days and the young mites feed upon the juices of the leaf. If the blisters are examined closely, tiny openings will be seen; these are made by the mites on entering and leaving the leaf. The chief injuries by the Blister Mite are to the leaves, but the fruit stems and fruit are often attacked. Prof. Lochhead in writing of this pest, in the Annual Report of the Fruit Growers' Association for 1908, says: 'The galls on pear leaves are at first greenish, then reddish, afterwards bright red, and finally with the death of the affected tissues, brown or black, often most conspicuous on the sides of the midrib. When the mites are very numerous the injuries produce defoliation of the trees. The colour of the galls on apple leaves is much less striking than that on pear leaves. The galls are usually more abundant on the margins of the leaves, and are at first greenish, soon becoming brownish, and only occasionally red. The coalescence or merging together of several of the galls produce irregular-shaped dead areas, which often rupture at the margin.' Quoting from Prof. Parrott, he says: 'About July first the most striking effects of the mites upon the leaves appear, especially if there is much yellowing of the foliage, as frequently occurs. Upon the upper surfaces of such leaves the mite-infested spots are of a light brown or of a dark green colour, and are uniformly brown beneath. These spots are thickly massed, forming a dark, broad band of irregular width along each side of the leaf, which contrasts con with the intervening light yellow area about the main rib. To one standi. ground and viewing the leaves from beneath, this striping of the leaves suggestive of the variegated foliage of certain ornamental plants.'

The remedy for the Pear Leaf Blister Mite is to spray the trees with the sulphur wash just as the buds are swelling. Although the mites pass the winter hide, away securely beneath the bud-scales, the expanding of the buds in spring opens the bud-scales sufficiently to allow the entrance of the spraying mixture.

#### DONATIONS TO COLLECTIONS OF INSECTS AND PLANTS.

Among the more important donations to the collections of insects and plants of the Division of Entomology and Botany, which have been made during the year ending March 31, 1909, the following may be mentioned:—

J. R. Anderson, Victoria, B.C. Pressed botanical specimens of *Delphinium* menziesii, and other interesting plants.

G. Chagnon, Montreal, Que. A fine specimen of the noctuid moth Graphiphora furfurata.

Norman Criddle, Treesbank, Man. Many specimens of rare Manitoban lepidoptera. Horace Dawson, Hymers, Ont. Specimens of arctian and noctuid moths of

special interest, taken at Hymers.

W. A. Dent, Sarnia, Ont. Seeds and living roots of Dioscorea villosa.

Rev. H. Dupret, Montreal. Fine specimens of Charophyllum sativum, Anthriscus cerefolium, &c.

Miss B. Green, Fairview, B.C. Several pressed botanical specimens, including *Pedicularis langsdorffii*.

A. W. Hanham, Duncans, B.C. Four boxes containing collections of lepidoptera, coleoptera and hymenoptera, all in splendid condition, among which were many rare specimens.

Rev. J. H. Keen, Metlakatlah, B.C. A good series of the rare Byrrid, Exoma pleuralis and other insects.

W. Metcalfe, Ottawa. Diptera and other insects collected in Ontario.

Mrs. D. W. Stewart, Renfrew, Ont. A botanical sheet of Medicago falcata.

Rev. G. W. Taylor, Nanaimo, B.C. Many specimens of lepidoptera, coleoptera, hymenoptera and a named collection of neuropteroid insects, all from British Columbia.

Rev. Frere Victorin, Longueuil, Que. Pressed botanical specimens of Rubus hispidus and Rubus permixtus.

E. P. Venables, Vernon, B.C. Specimens of hemiptera and other insects from British Columbia.

J. B. Wallis, Winnipeg, Man. A fine series of *Catocala coccinata*, together with acceptable noctuids, and named specimens of neuropteroid insects.

Miss E. Maude Warren, Kelowna, B.C. Living plant of *Cypripedium occidentale* and botanical specimens of *Enothera muricata*, *Potentilla camphorum*, and other plants for the herbarium.

C. H. Young, Ottawa. Beautifully mounted specimens of micro-lepidoptera, some of which have been only recently described.

#### THE APIARY.

The apiary is under the management of Mr. D. D. Gray, the farm foreman, whose. report I append herewith. The practical work of handling and caring for the bees has been done by Mr. C. A. Burnside. It was thought best to reduce the number of colonies in the apiary during the year, and some of the strong and healthy ones were sold and the number on our stands was thus reduced to thirty-two.

#### REPORT OF APIARY FOR SEASON OF 1908-9.

to report a fairly successful year with the bees. The weather at the beginthe season was much the same as in 1907—very wet and cold. The bees were their summer stands on April 24, coming from their winter quarters in good andition.

They were put in the bee cellar in the fall of 1907, weighing an average of 56.4 pounds each, and, when put out in spring of 1908, the weight was 38.6 pounds each, having lost an average of 17.8 pounds per colony during the winter, somewhat higher than most years. The first supers were put on on May 27 and the extractor was started on July 9.

An effort was made to retard swarming as much as possible; there was, however, an increase of ten swarms during the season, the first coming off on June 20.

The bees were put in the bee-cellar at the close of the season on November 6, all the colonies weighing over 50 pounds each.

An experiment was carried on during the winter to get some data as to the amount of air-space required to winter the colonies satisfactorily.

As there is yet practically a month before the bees go out, and this the most trying month of the year, nothing definite can be said at present as to the state of the colonies; all save one appear to be in good condition.

D. D. GRAY.







