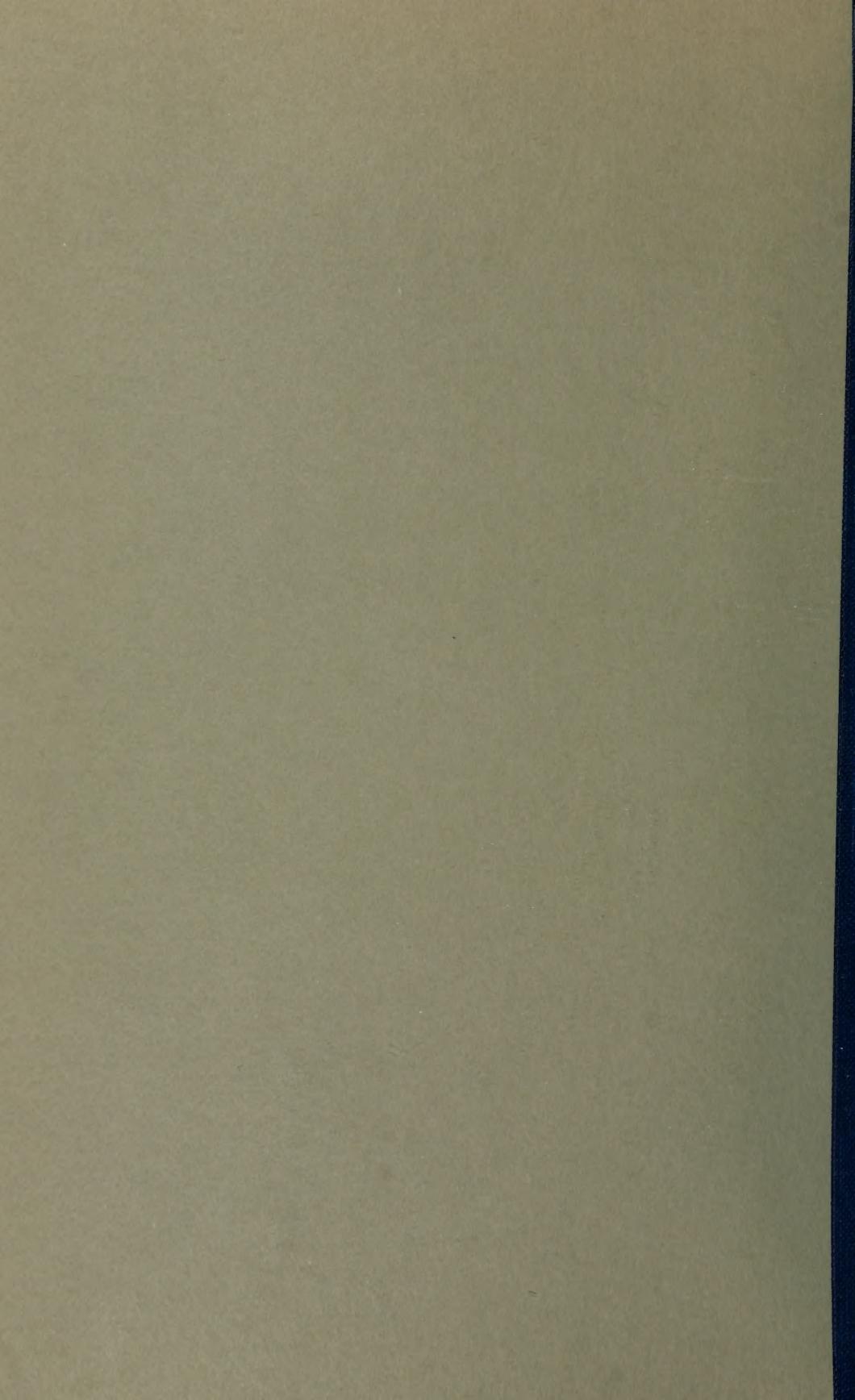


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Report of the Dominion Entomologist

(1912-13)

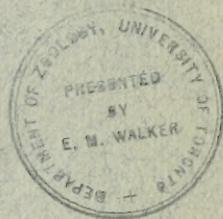


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DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

REPORT

FROM



THE DIVISION OF ENTOMOLOGY

For the Fiscal Year Ending March 31, 1913

PREPARED BY

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

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REPORT

FROM THE

DIVISION OF ENTOMOLOGY

C. GORDON HEWITT, D.Sc., Dominion Entomologist.

OTTAWA, March 31, 1913.

J. H. GRISDALE, Esq., B. Agr.,

Director, Dominion Experimental Farms.

Department of Agriculture, Ottawa.

SIR,—I have the honour to submit herewith my fourth Annual Report of the work of the Division of Entomology covering the year beginning April 1, 1912, and ending March 31, 1913. A summary of the chief lines of work upon which we have been engaged during the above period has been submitted to you separately and in the present report a more detailed account of our investigations and of the depredations of those insects which were unusually abundant and injurious is given for the use of those desiring more information on the subject.

The most notable advance in our work during the past year has been the extension of our sphere of investigation and assistance by the establishment of field laboratories in certain of the provinces. The existence of many pressing problems which could only be investigated in the regions in which they occurred, rendered this development necessary. The expansion of our organization in this direction has not only enabled us to commence a series of thorough investigations on certain insect pests, which will be specified later, but it has placed the Division in direct contact with the farmer and the fruit grower with the result that our officers located at the field laboratories are able personally to advise enquirers in regard to injuries due to insect pests, and by their attendance at meetings to interest farmers in methods of insect control. Still more important is the fact that on the receipt of reports of serious injuries we are able in many cases to instruct our field officer in the particular district to visit the farmer, investigate and if possible advise. The value of such immediate and personal contact between the Division and the farmer is only too evident; it is the most helpful form of assistance we can render. The appreciation with which this extension of our work has been met and the valuable results already obtained indicate the desirability of a continued development of the policy.

For the sake of convenience the report of our work may be considered under the following sections:—

1. The Administration of the Destructive Insect and Pest Act, including:
 - (a) Inspection and fumigation of imported nursery stock, etc.
 - (b) Field work against the Brown-tail Moth and parasite work.
2. Insects affecting field crops.
3. Insects affecting fruit crops.
4. Insects affecting forest and shade trees.
5. Insects affecting domestic animals and man.
6. Insects affecting garden and greenhouse.
7. Apiculture.
8. Miscellaneous.

I.—ADMINISTRATION OF THE DESTRUCTIVE INSECT AND PEST ACT.

(a.)—THE INSPECTION AND FUMIGATION OF IMPORTED NURSERY STOCK.

During the importation season of 1911-12 over 3,800,000 trees and plants imported into Canada were inspected. In order to indicate the importance of this inspection work and the need for constant vigilance I may mention the discovery by our officer at Vancouver during the inspection work, early in 1912, of eight egg masses of the Gipsy Moth (*Porthetria dispar*) in an evergreen (*Thuja*) from Japan. Before the egg masses reached the Department several hundred of the larvæ had emerged. European shipments, we are pleased to note, are remarkably free from Brown-tail Moth infestation owing largely, no doubt, to the marked improvement in the inspection of the nurseries in Europe. Scale insects, woolly aphids and certain other species of insects are still too common on imported nursery stock, and there are several serious pests from which we are as yet free but by which we are menaced. These demand that careful attention shall be paid to our imported trees and plants.

On learning of the wide distribution and prevalence of the Mediterranean Fruit Fly (*Ceratitidis capitata*) in the Hawaiian Islands, from which fruit is imported into Canada, a full inquiry was made as to the possibility of its introduction into Canada, and being convinced that its presence in those islands constituted a menace, the importation of all non-canned fruit from the Hawaiian Islands was prohibited by the passing, on April 19, 1912, of Regulation No. 16, under the Destructive Insect and Pest Act.

For some time considerable apprehension had existed concerning the possibility of the importation of the egg masses of the Gipsy Moth on forest plant products, such as logs, rough-timber, etc., from the infested New England States. No regular inspection service existed there, but upon the organization of the Federal Horticultural Board of the United States Department of Agriculture and the enactment by the Board of a regulation requiring the inspection of such forest plant products, the following Regulation No. 17 was passed in December, 1912, a slight amendment being made in February, 1913:—

Regulation 17.—Forest plant products, including logs, tan bark, posts, poles, railroad ties, cordwood and lumber originating in any one of the States of Maine, Massachusetts, New Hampshire, Connecticut and Rhode Island, five of the United States of America, shall not be admitted into Canada unless such forest plant products shall be accompanied by a certificate showing that they have been inspected by the United States Department of Agriculture and found free from the Gipsy Moth. Each shipment shall be accompanied by such an inspection certificate, and the certificate shall accompany the bill of lading, way-bills or other memoranda pertaining to such shipments.

The importation of coniferous trees, such as spruce, fir, hemlock, pine, juniper (cedar) and arbor-vitæ (white cedar) or foliage thereof, and decorative plants such as holly and laurel known and described as "Christmas greens" or greenery, from the States of Maine, Massachusetts, New Hampshire, Connecticut and Rhode Island, is prohibited.

The prohibition of the importation of coniferous trees from the infested States was rendered necessary owing to the practical impossibility of inspecting them with any degree of certainty.

(b.)—FIELD WORK AGAINST THE BROWN-TAIL MOTH AND PARASITE WORK.

In my last annual report I referred to the increased area of infestation of the Brown-tail Moth in New Brunswick. The scouting work in New Brunswick, of which Mr. J. D. Tothill had charge and which was concluded in the spring, but after

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the beginning of the present fiscal year, showed that seven counties, namely, Charlotte, Carleton, York, Sunbury, Queens, Kings and St. John, were included in the infested area. The area of infestation had increased from about 400 square miles, in 1910, to approximately 6,400 square miles in 1911. The light character of the infestation may be gathered from the fact that over this area only 2,452 winter webs of the Brown-tail Moth were found. The distribution of the webs were as follows:—

	Webs.
Charlotte county.	1,812
Carleton county.	16
York county.	300
Sunbury county.	256
Queens county.	58
Kings county.	8
St. John county.	2
	<hr/>
Total.	2,452

The following list indicates the distribution of the winter webs on the food plants in New Brunswick during the season 1911:—

Apple.	2,196	Maple.	11
Bilberry.	80	Oak.	2
Thorn.	73	Beech.	2
Choke cherry.	45	Pear.	1
Elm.	15	Willow.	1
Plum.	13	Poplar.	1
Pennsylvania cherry.	12		
		Total	<hr/> 2,452

The discovery of winter webs on low-growing vegetation, such as bilberry, thorn and choke cherry, increases the difficulties of our control work in New Brunswick, where the topographical and other conditions differ very materially from those occurring in Nova Scotia. In New Brunswick it was found that birds had directly and indirectly contributed to the destruction of hibernating larvæ, directly by the actual destruction of the larvæ and indirectly by opening the winter webs and thereby subjecting the young larvæ to the weather conditions from which they are usually more protected. The distribution of the agricultural lands in the southern section of New Brunswick affects the distribution of the moth. The infestations occur on the cultivated high lands, or ridges, the intervening valleys being wooded. This is shown by the nature of the chief food plants, apple on the farms, and bilberry, thorn and choke cherry on the cultivated portions of high lands. A count which Mr. Tothill made of the larvæ contained in 121 winter webs gave an average of 175.8 larvæ per web. This is less than the average.

Mr. G. E. Sanders had charge of the scouting work in Nova Scotia, and the infested region was covered by three parties of men with the co-operation of the provincial Department of Agriculture, as was also the case in New Brunswick. It was found that the area of infestation has spread eastward, a single nest being found at Brooklyn, Kings county. Altogether, 7,703 webs were collected, as compared with 4,490 collected in the season 1910-11. Considerable improvement had resulted in certain sections from the thorough scouting work which had been done in the previous season, 1910-11. In Weymouth, 562 webs were collected, as compared with 1,511 in the previous season. On the other hand, one or two localities showed an increase. In Bridgetown, 1,362 webs were collected; in 1910-11, 601 webs had been found. It should be pointed out, however, that the number of webs collected may not accurately indicate the infestation, as in many cases the webs are collected and destroyed by the owners of the properties. An increase in the number in any locality might be due to the neglect of the owners of the infected trees to remove the nests.

During the spring, the notice reprinted on the next page, was sent to all post offices, and copies printed on cotton were posted in prominent places throughout the infested territory in Nova Scotia and New Brunswick.

The following list indicates the distribution of the winter webs on various food plants in Nova Scotia during the season 1911-12:—

Apple..	6,842	Sweet cherry	5
Plum..	274	Apricot	3
Thorn..	241	Beech..	3
Pear..	181	Willow..	3
Wild pear..	68	Wild cherry..	2
Elm..	32	Birch..	1
Maple..	18	Rose..	1
Oak..	16		
Quince..	13	Total..	7,703

IMPORTATION OF PARASITES, ETC., OF THE BROWN-TAIL AND GIPSY MOTH.

The arrangements forecasted in my last annual report for the establishment of a field station in New Brunswick for the purpose of introducing and colonizing certain of the natural enemies of the Brown-tail and Gipsy Moths were completed, and the University of New Brunswick not only most kindly allowed us the use of the site for our laboratory in the university grounds at Fredericton, N.B., but also permitted us to occupy one of their large laboratories during the summer vacation, which greatly facilitated our work at a time when additional space for the breeding trays 'was required. Dr. L. O. Howard, Chief of the United States Bureau of Entomology again most courteously permitted us to obtain supplies of the Tachinid parasite *Compsilura concinnata* Meign, and the predaceous beetle *Calosoma sycophanta*.

Mr. J. D. Tothill, who had charge of the parasite work in New Brunswick, visited Massachusetts in July, 1912, and collected over 12,000 caterpillars of the Gipsy Moth, from which 2,395 specimens of *Compsilura* were obtained. This lot of material was used to establish two strong colonies of the insect, one near Fredericton and the other near St. Stephen, N.B., both colonies being liberated under excellent conditions. Subsequent examination of the puparia indicated that about seventy-five per cent of the flies had successfully emerged. In the case of the Fredericton colony, Mr. Tothill made an observation of considerable interest and value. Collections were made later in the season of the caterpillars of the Fall Webworm (*Hyphantria cunea*) and the larvæ of the Tachinid *Compsilura* were obtained from caterpillars of *H. cunea*, collected at a point three miles, as the crow flies, from the point where the parasites were liberated, demonstrating that the female Tachinid in flying this distance had crossed the river St. John, three-quarters of a mile wide. This discovery would appear to augur well for the future dispersal of the species.

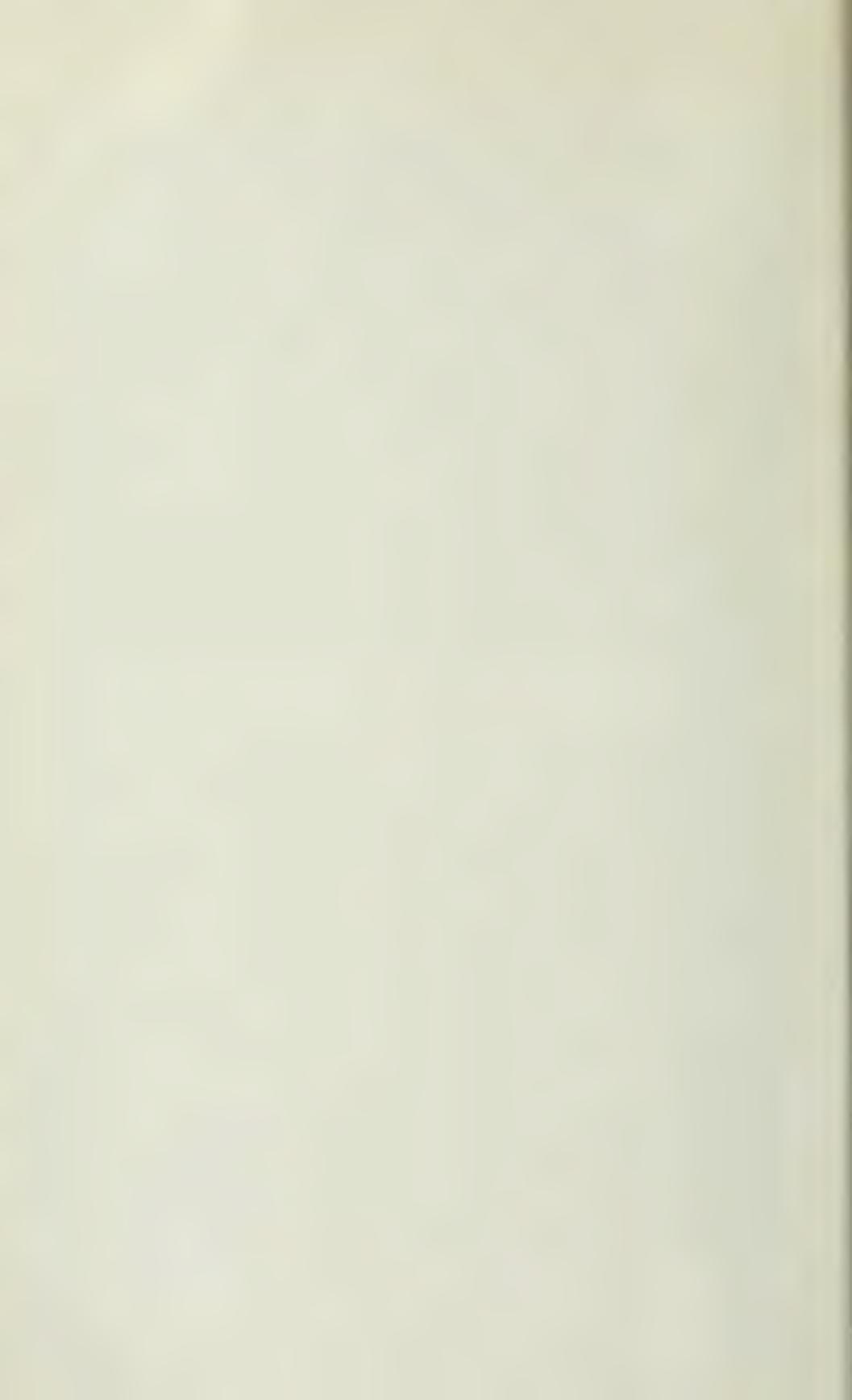
Through the kindness of Mr. A. F. Burgess, in charge of the Gipsy Moth parasite work in the New England States, a collection of eighty adult *Calosoma* beetles was made in Massachusetts and sent to our laboratory at Fredericton. They were received in excellent condition, and Mr. Tothill immediately commenced breeding work, but was handicapped by the cold and wet season which rendered the large amount of food supply, consisting of living caterpillars, difficult to obtain. However, Mr. Tothill was successful in rearing a sufficient number of *Calosoma* larvæ to enable an experiment to be made with a view to ascertaining whether the pupal stage of *Calosoma* is able to pass the winter under New Brunswick conditions. Adults were also allowed to go into hibernation at Fredericton, and a small colony of about fifteen pairs of adults was liberated at St. Stephen, N.B. If encouraging results are obtained from these experiments during the coming spring, it is proposed



Dominion Entomological Field Station. Agassiz, B. C.



Dominion Entomological Field Station, Bridgetown, N. S.





IMPORTANT NOTICE

In view of the alarming increase of

THE BROWN-TAIL MOTH

in this region, and the necessity of taking immediate steps to control this most serious pest of orchard, shade and forest trees, the attention of all farmers, fruit growers, and other occupiers of premises upon which fruit and other trees exist, is called to the following Regulation issued under "The Destructive Insect and Pest Act":

REGULATION 8. "Any inspector entering any lands, nursery or other premises where there is reason to believe that any of the insects, pests or diseases hereinafter specified are or may be present, shall give instructions for the treatment or destruction of any tree, bush, crop or other vegetation or vegetable matter or the containers thereof, which may be found or suspected to be infested with any of the insects, pests or diseases hereinafter specified, and such instructions shall be carried out by the owner or lessee of the infested or suspected vegetation, vegetable matter, or containers thereof, and such remedial treatment shall be carried out and continued until the insect, pest or disease shall be deemed by the inspector to have been exterminated."

Under this Regulation it will be necessary for all owners of trees, upon which nests of the Brown-tail Moth occur, to remove such nests and burn them and, in the case of heavily infested trees and vegetation, to spray such trees or vegetation in strict accordance with the instructions given by the Department's Inspectors.

PENALTY:

Section 8 of the Act states:

"Every person who contravenes any provision of this Act, or any regulation made thereunder, shall be liable, upon summary conviction, to a fine not exceeding one hundred dollars, or to imprisonment for a term not exceeding six months, or to both fine and imprisonment."

GEO. F. O'HALLORAN,

Deputy Minister of Agriculture.

Department of Agriculture,
Ottawa.

to conduct more extensive breeding experiments at the Fredericton laboratory during next summer (1913).

In addition to the aforementioned work, Mr. Tothill commenced an exhaustive study of the parasitism of the Forest Tent Caterpillar (*Malacosoma disstria*) and the Fall Webworm (*Hyphantria cunea*), one of the chief objects of which was to discover what facultative parasite of the Brown-tail and Gipsy Moths were attacking these common native insects. It is also proposed to make a study from year to year of these native parasites of these common insects with a view to elucidating some of the complex problems associated with the important subject of the natural control of insects. A large amount of valuable information was obtained in the short season during which the work was carried on.

II.—INSECTS AFFECTING FIELD CROPS.

CUTWORMS.

The most serious of the insects affecting field crops during 1912 have undoubtedly been cutworms of various species. In southern Alberta their depredations were very extensive and unusually severe. With a view to ascertaining the extent of the injuries and of the infested territory in Alberta, inquiries were addressed to farmers and individuals reporting injuries, and the co-operation of the crop-reporting agencies of the Census and Statistics Branch of the Dominion Department of Trade and Commerce, the Department of Agriculture, of Alberta, and of the Commission of Conservation was secured. Mr. W. H. Fairfield, Superintendent of the Experimental Farm at Lethbridge, also very kindly collected statistics. From all these sources it was found that between 30,000 and 35,000 acres of grain were actually destroyed by cutworms in southern Alberta during 1912. The most seriously infested districts appeared to have been Lethbridge, Macleod, Monarch, Pincher Station and Claresholm. The infested area was found to extend, approximately, from Claresholm in the northwest to Wagner in the southwest, and from Spring Coulee in the southwest to Turin on the northeast. They were particularly destructive to garden crops, including cabbages, turnips, onions, peas, beets and carrots, and in addition to destroying wheat, which was the chief crop attacked, they ate oats, barley and timothy. The damage was reported to have commenced about the middle of April and to have extended into the middle of June. The most destructive species appeared to be *Prosa-grotis delorata* Sm. and *Euxoa ochrogaster* Gn. The ordinary remedial measures for cutworms did not prove effectual, and on this account, together with the fact that one of the species (*P. delorata*) was a new pest, arrangements have been made for a thorough investigation into the outbreak. For this purpose a field officer (Mr. E. H. Strickland) has been appointed, and an entomological laboratory will be established at Lethbridge.

CHINCH BUG INVESTIGATION.

Owing to the extensive damage by the Chinch Bug (*Blissus leucopterus* Say) in Middlesex county, Ontario, during 1911, to which reference was made in my last annual report, and the possibility of this very injurious pest of staple grains spreading from the infested area in western Ontario, a careful investigation was carried on by Mr. H. F. Hudson at a temporary field station at St. Ives, Middlesex county, Ont.

In the early part of the year, our field officer, Mr. G. E. Sanders, visited the region and made observations on the insects in winter quarters. Mr. Hudson commenced work about the middle of May, when the bugs were mating. A study of their life-history and habits was made. The infested region is largely devoted to

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pasture, with some hay land; it covered about five square miles, embracing about 1,800 acres. Meadow grasses suffered most, particularly timothy. Wheat, corn and oats were slightly injured, but only where such crops were adjacent to a meadow or pasture. The restricted nature of the infestation appeared to be due to the scarcity of grain crops and the succulent nature of the grasses. The value of regular systems of crop rotation was demonstrated by the scarcity of Chinch Bugs in such land compared with their abundance on the grass farms. Under the present system of grass farming, which appears to be the result of economic conditions rather than desire, the Chinch Bug injury is likely to increase unless the region should be favoured with an open winter or a wet summer, as heavy rains occurring during the time the bugs are hatching is inimical to the progress of the pest. The season of 1912, fortunately, materially reduced their numbers. It was also found that the white fungus *Sporotrichum globuliferum* appeared in September after the wet season and killed off about twenty-five per cent of the bugs. Experiments on this fungus were carried out. The most important measures to be adopted are clean farming and the adoption of regular rotations. Clean farming includes the destruction of rubbish, the cleaning up of fences, etc., and the burning over of waste places as late as possible in the fall to destroy the hibernating places and to expose the bugs to the rigours of winter. It is intended to publish the results of the investigation as soon as may be practicable.

During the year, Mr. G. E. Sanders has found the Chinch Bug sparingly in the Annapolis valley in Nova Scotia, where, however, it is unlikely to become a pest.

EELWORMS.

In September, 1912, injured wheat plants were received from Raymond, Alta. In these plants no sign of insect or fungus injury could be discovered. A microscopic examination, however, disclosed the presence of numerous nematodes, commonly called Eelworms, at the base and along the lengths of the stems of the plants. So far as we are aware, this is the first record of injury to staple crops by these pests in North America. While they are not insects, but belong to the large family of worms, the entomologist is usually called upon to give them his attention. They are microscopic, thread-like, transparent creatures measuring, when full-grown, about one twenty-fifth of an inch in length. Further inquiries were made and it was found that Eelworms were present in other districts in southern Alberta, their injuries having been attributed to other obscure causes such as climatic or soil conditions. Winter wheat was chiefly affected. In Europe, where the Stem Eelworm, *Tylenchus devastatrix*, is responsible for serious injury to crops, such as wheat, oats, clover, hops and onions, when it occurs in numbers, infestation of wheat is not common and spring wheat is most frequently attacked. In oats, a condition known as 'tulip root' is produced.

As these pests will undoubtedly spread, and are very difficult to control, careful attention is being given to their occurrence with a view to planning a detailed investigation as soon as practicable. In Europe, the control measures usually recommended are the careful selection of rotations, the sowing of a crop which appears to be immune, such as barley, the planting of trap crops, the use of fertilizers, such as sulphate of potash and nitrate of soda, the dressing of the land with lime, salt, etc., deep ploughing and the destruction of infested crops. Many control measures practised in England, France and Germany are impracticable in Alberta, and the whole problem will demand careful investigation and experiment under our western conditions.

MISCELLANEOUS REPORTS.

White Grubs (*Lachnosterna*) were very abundant in certain parts of Ontario. This was expected, as the adult beetles occurred in enormous swarms in the spring of 1911, in which year the eggs would be laid. One correspondent reported as many as thirty grubs from one hill of potatoes, and fifteen to twenty grubs were quite common.

Wireworms were reported from every province. They destroyed potatoes and root crops universally; in Ontario, Manitoba and Alberta they destroyed both winter and spring wheat, and oats and clover were also attacked. Mr. H. F. Hudson, our field officer in western Ontario, was instructed to study their habits and depredations with a view to future work. The Seed Corn Maggot (*Pegomyia fusciceps*) was unusually injurious in Ontario.

Our investigations on the control of Root Maggots were again continued in the insectary grounds at Ottawa.

III.—INSECTS AFFECTING FRUIT CROPS.

The establishment, during the past summer, of field laboratories in most of the provinces has enabled us to begin investigations on the more important of the insect pests affecting both orchard trees and small fruits.

INVESTIGATIONS IN NOVA SCOTIA.

In Nova Scotia, a laboratory (illustrated herewith) has been established at Bridgetown, N.S., with Mr. G. E. Sanders in charge. A ten-acre orchard has been placed at our disposal for experimental work in spraying by Mr. R. S. Eaton, for whose co-operation we are indebted, at Kentville, N.S., where a series of experiments on the control of the Bud-moth, *Spilonota ocellana*, was begun; conjointly, the control of the Codling Moth and of the Green Fruit Worm, *Xylina* spp., is being studied. It has been found that more than one species of Budmoth occurs, and that the spray usually recommended for this insect does not control it. A larger species, *Olethreutes frigidana* Paek., not previously regarded as of economic importance, was found to be injurious. The value of spraying and cultivation in the control of the Green Fruit Worms, *Xylina* spp., chiefly *X. bethunei*, was investigated. In certain sections these insects are responsible for a marked proportion of damaged fruit. The first occurrence of the Apple Maggot, or Railroad Worm (*Rhagoletis pomonella*), in Nova Scotia, was discovered at Smith's Cove, N.S. It appears to be localized, and the infestation in the affected orchard is light.

SAN JOSÉ SCALE IN NOVA SCOTIA.

Not the least important of Mr. Sanders' work was the discovery, for the first time, of living San José Scale (*Aspidiotus perniciosus*) in Nova Scotia on nursery stock imported from Ontario. The first case was discovered in the spring of 1912, at Aylesford, N.S., during the Brown-tail Moth scouting work. We immediately notified Prof. M. Cumming, Secretary for Agriculture for Nova Scotia, of the fact, and arrangements were made without delay for the inspection by the Provincial Government of all Ontario nursery stock planted during the years 1910, 1911 and 1912, and Mr. Sanders had charge of the provincial force of inspectors. Regulations were passed by the Provincial Government under their *Insect Pest and Plant Disease Act* to meet the requirements of the situation, and practically the whole of the west-

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ern fruit belt was inspected, from Hants county in the east to Yarmouth county in the west. The infected properties were scattered over about 175 miles of territory. The following indicates the extent and result of the work:—

Number of properties inspected.	1,758	
Number of trees inspected (over).	157,065	
Number of properties infested with scale, living or dead.	785	
Number of trees of 1910 planting destroyed.		7
“ “ 1911 “		345
“ “ 1912 “		341
		693
Total of trees destroyed.		693

Living scale was found as follows:—

On trees of 1910 planting, on 3 properties.			
“ 1911 “ 71 “			
“ 1912 “ 127 “			

The fact that, altogether, living scale was found on 201 properties, on trees planted from 1910 to 1912, indicates the great importance of this discovery and the wisdom of taking immediate action. In October, 1912, the Provincial Government of Nova Scotia passed regulations requiring certificates that the nurseries from which Canadian* nursery stock imported into the province had been inspected between June 15 to September 15, and the regulations further provided that such nursery stock should be fumigated in fumigation houses established at Truro, N.S., and Digby, N.S. Most of the Canadian nursery stock imported into Nova Scotia originates in Ontario nurseries. Under the regulations of the Ontario Government, the fumigation and inspection of nursery stock is already provided for, so that the regulations of Nova Scotia will facilitate the enforcement of such necessary requirements. The Provincial Government of Nova Scotia proposes to make a thorough inspection of the entire fruit belt during the coming summer (1913). It is not improbable that the immediate steps which are thus being taken to eradicate the infection will prevent the scale from spreading and in the end, prove successful.

INVESTIGATIONS IN QUEBEC.

A field laboratory was established, after consultation with the Quebec Pomological Society, at Covey Hill, Quebec, in the orchard of Mr. G. B. Edwards, for whose co-operation and interest we are indebted. As it was not possible to commence work until the latter part of July, little more than a beginning could be made. Nevertheless, Mr. C. E. Petch, our field officer who was placed in charge, succeeded in initiating one or two investigations on important fruit insects in that region, in addition to collecting a good deal of information of a miscellaneous character on the insects affecting fruit and fruit trees. The four most important orchard pests in the district are the Apple Maggot (*Rhagoletis pomonella*), Codling Moth (*C. pomonella*), Plum Curculio (*Conotrachelus nenuphar*) and the Apple Curculio (*Anthonomus quadrigibbus*). Owing to the fact that our knowledge of the last-named insect, *A. quadrigibbus*, which is a serious apple pest in European countries, has received little attention on this continent compared with the other insects mentioned, it was decided to pay particular attention to a study of its life-history and control, concurrent obser-

*Nursery stock imported into the province from countries outside Canada is already governed by the Dominion Regulations under *The Destructive Insect and Pest Act*.

vations being made on *R. pomonella* and *C. nenuphar*. The chief injuries of the Apple Coreulio are inflicted by oviposition and feeding. The egg punctures cause hard green core-formations extending sometimes to the centre of the apple. The egg punctures are responsible for malformed apples. A good beginning was made in the study of the life-history and feeding habits, and of the varieties attacked.

INVESTIGATIONS IN ONTARIO.

At the entomological station at Jordan Harbour, Ont., the establishment of which was mentioned in my last annual report, Mr. W. A. Ross, the officer in charge, continued his investigations on the Apple Maggot (*Rhagoletis pomonella*). In this work, Mr. Charles Good, working under the direction of Mr. L. Caesar, Provincial Entomologist, co-operated with Mr. Ross. In spite of the very adverse weather conditions during the summer, an extended series of valuable observations was made on the following: Emergence and behaviour of adults, oviposition and incubation of eggs, mortality of eggs and larvæ, the relative value of various baits and repellants, spraying with sweetened arsenicals, cultural methods of control, the use of soil fumigants, the varieties of apples affected and the emergence of larvæ from different varieties as affecting the destruction of fallen fruit, and natural hosts, etc. Many of the experiments gave indifferent results, but the unreliability of ploughing under pupæ, among other things, was clearly demonstrated. An interim report of this work is being published (in the *Forty-third Annual Report, Ent. Soc. Ontario*), and the investigations will be continued during the coming season (1913).

INVESTIGATIONS IN BRITISH COLUMBIA.

During the summer, Mr. R. C. Treherne was located at a temporary field station at Hatzic, B.C., in the Fraser valley. Mr. A. Brealey, of Hatzic, most kindly provided us with working accommodation and facilities for experimental work. An investigation was undertaken of the life-history and control of the Strawberry Root Weevil (*Otiiorhynchus ovatus*) which is one of the most injurious of the small fruit pests in that region of the province, where it is abundant. The death of the plants is caused by the girdling of their roots by the larvæ. As a rule, the strawberry fields do not suffer until the spring of the second year after planting. Extended observations were made on the biology of the weevil. The inability of the beetle to fly suggested methods of preventing their migration to uninfested plots, and a number of obstructive devices are under trial. The effect of crop rotation and cultural methods are also being studied in conjunction with the prevailing local cultural practices. Mr. Treherne made observations on a number of the insects, injurious locally, and answered enquiries in regard to the same. The Western Tent Caterpillar (*Mala-cosoma crosa*) was responsible for extensive defoliation of apple trees in the Fraser valley. Elater beetles appear to be responsible for injuries to the buds and blossoms of apples. A large number of insects of economic importance are awaiting study, and the varied climatic and soil conditions in the province will provide us with abundant material for investigation.

As headquarters for our entomological work in British Columbia, an entomological laboratory (illustrated herewith) has been built on the Experimental Farm at Agassiz. It contains a working laboratory, insectary, living room and store-room, lavatory, etc., all of which will provide us with much needed accommodation for our work and for the officer in charge.

IV.—INSECTS AFFECTING FOREST AND SHADE TREES.

The appointment of Mr. J. M. Swaine as Assistant Entomologist to take charge of Forest Insect Investigations enabled us to extend our studies in this most important branch, and Mr. Swaine has devoted his whole attention to this work, studying, in particular, the Bark Beetles (*Ipidæ*) which constitute the most deadly and widespread enemies of our forests. In May, 1912, Mr. Swaine visited the Riding Mountain Forest Reserve in Manitoba. The primary object of his visit was to colonize a large collection of the cocoons of the Larch Sawfly, *Nematus erichsonii* containing its parasite *Mesoleius tenthredinis*. These cocoons had been collected in the English Lake district, which I visited with that object, as mentioned in my last annual report. The weather conditions were not very favourable; nevertheless, the parasitized cocoons were distributed by Mr. Swaine in two large tamarack swamps in the Riding Mountains east of Clear lake. It was found that bark beetles were present in the reserve in great numbers in fire-injured timber and in slash from cuttings. *Dendroctonus murrayana* Hopk. had destroyed some timber. *D. simplex* was very numerous in dead and standing larches, and is no doubt serious as a co-destructive agency with the Larch Sawfly. *Ips perturbatus* Eichh. and *I. caelatus* Eichh. were abundant in fire areas south of Clear lake, occurring chiefly in white spruce which was badly injured by fire. *Polygraphus rufipennis* Kirby was found common everywhere in dying bark of spruce, larch and jack pine. These were the chief species of bark beetles found and they are able to kill weakened or injured trees which might otherwise recover. Timber beetles of several species were plentiful, the most common being the Poplar Timber Beetle *Trypodendron retusis* Lec. and the Spruce Timber Beetle *T. lineadas* Ratz. in spruce and pine. The effect of *Pissodes* injury was very noticeable in numerous, "double tops" on the spruce.

A visit was made by Mr. Swaine to Algonquin Park, Ont., in July. Abundant evidence of serious injury by bark beetles was found. Observations on the habits and life histories and collections were made of the following: *Dryocoetes vichoffi* Hopk. on birch, *Dendroctonus* and *Dryocoetes* in white spruce, *Polygraphus rufipennis* in white and black spruce, *Ips balsameus* on balsam, *Monohammus scutellatus*, etc. The timber limits of the Canada Paper Co., at Stoke, Que., were also visited and important observations were made on the bark beetles and other forest insects prevalent in this important forest region of Quebec.

TENT CATERPILLARS.

Malacosoma americana and *M. disstria* were very abundant in certain parts of Ontario, Quebec and New Brunswick, and particularly in the districts around Ottawa and Montreal. *M. disstria* was responsible for extensive defoliation of forest trees in the Gatineau region, north of Ottawa. The caterpillars were so numerous that the trains on the Gatineau branch of the Canadian Pacific Railway were held up on certain of the grades, in spite of double engines and mechanical devices for clearing the rails. Very few parasites were found, and, although the bacterial diseases were evident, the countless numbers of moths which deposited their egg masses thickly on the trees indicate a more serious visitation next year, and a circular on Tent Caterpillars has been prepared by Mr. Swaine, and is now in the press.

The Spruce Budworm, *Tortrix fumiferana*, appears to be gradually spreading eastward, as more reports have been received from the region south and east of the St. Lawrence, and it is more in evidence in New Brunswick. Districts in Quebec, north of Ottawa, which were seriously defoliated in 1909, appear to have recovered

from the attacks, and no cases of fatal injury have been discovered which could be ascribed to this insect, which is still under investigation.

Various species of scale insects have been recorded as injurious and are under observation, *Chermes similis* Gillette and *C. abietis* Chol. have been destructive to shade trees and are very common locally in spruce forests. *C. pinicorticis* Fitch is common and destructive throughout eastern Canada. *C. strobilobius* Kalt, was particularly abundant at Ottawa on both European and American larches. *Gossyparia spuria* Mod. is proving injurious to elms at Ottawa.

In Nova Scotia, the Larch Case-bearer, *Coleophora laricella*, is still very abundant; at Ottawa it was particularly prevalent on American and European larches.

Among other insects affecting forest and shade trees which were more noticeably abundant, and reported during the year of 1912, were the following: *Galerucella decora*, stripping willow and poplar in Manitoba, Saskatchewan and British Columbia; *Podosesia syringae* Harris destroyed stems of lilac at Ottawa; *Cyllene robinie* Forst. was destructive to acacias in Southern Ontario; *Elaphidion villosum* was responsible for extensive injuries to oaks in some of the St. Lawrence Island parks. *Saperda* spp., including *S. calcarata*, a very destructive enemy of poplar, were responsible for numerous complaints from Ontario and Manitoba. *Agrius anxius* still continues to be a very destructive enemy to imported white birches around Ottawa, and in certain other eastern cities, where it is gradually killing the finest trees.

V.—INSECTS AFFECTING DOMESTIC ANIMALS AND MAN.

ROCKY MOUNTAIN SPOTTED FEVER TICK, *Dermacentor Venustus Banks.*

The occurrence of this tick in the Western States of the Union just south of the international boundary, and an isolated record of its capture at Kaslo, B.C., made it extremely desirable that a study of its distribution in Canada should be made, in view of the fact that it is the potential carrier of the fatal disease, from which it takes its name, especially prevalent in the Bitter Root valley, Montana. Accordingly, in November, 1911, through the co-operation of the Veterinary Director General, a letter was addressed to all the western veterinary inspectors, to the Farmer's Institutes, to local entomologists, and others, requesting the collection of ticks. Mr. J. W. Cockle, of Kaslo, B.C., was particularly active on our behalf, and rendered valuable assistance. As a result of this inquiry an excellent quantity of material was received from southern British Columbia, and also from Pincher Creek, Alta. The chief area of distribution of this species appears to be the Kootenay region, where they are found on the mountain sides; specimens received were taken from horses, grizzly bears, and man; they were also found on forest undergrowth, on which account they have no doubt received the popular name "wood ticks," which name also includes *D. albipictus*. Evidence collected indicates that this species may be responsible for paralytic symptoms in children and somewhat obscure petechial outbreaks. Observations were made in the laboratory on the oviposition, but attempts to get the ticks to feed on chipmunk and guinea pigs failed, and my absence in England resulted in the death of the seed ticks. The fact that the bites of these ticks undoubtedly have serious results, points to the necessity of avoiding their bites in the infested region.

THE STABLE FLY, *Stomoxys Calcitrans.*

On account of the possible relation of this biting fly to poliomyelitis, or infantile paralysis, which the experiments of Drs. Rosenau, Brues, Anderson and Frost have recently indicated, and also its character as an occasional pest of domestic animals,

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the experiments, which I began originally in 1906, were resumed. Not only was the life history studied, but special attention was paid to the feeding habits of the adult, several flies being fed entirely on human blood.

WARBLE AND BOT FLIES.

During the summer of 1912, Dr. S. Hadwen, of the Health of Animals Branch of this department, carried out a valuable series of experiments on the Warble fly *Hypoderma bovis* de Geer, the account of which has been published in Bulletin No. 16 of that branch. The chief interest in Dr. Hadwen's study lies in the fact that previously it had generally been supposed that this European species was not positively known to occur in North America, but that our only species of Ox Warble fly, or Bot fly, was *Hypoderma lineata* de Villiers. At Agassiz, in British Columbia, Dr. Hadwen found *H. bovis* was the common species. In going over the collections in the Division, I find that we received this species in July, 1911, from St. Henri de Lévis, Que., an adult specimen having been taken from the hoof of an ox. We have also received the larvæ of *H. bovis* from Saskatchewan. These facts would indicate that *H. bovis* is generally distributed through Canada.

The Sheep Nasal Fly (*Oestrus ovis*) was reported as becoming a pest on Salt Spring Island, B.C. Specimens of the larvæ of *O. ovis* were also received from the biological laboratory of the Health of Animals Branch; they had been taken from the head of a sheep received from Quebec in April, 1912.

VI.—INSECTS AFFECTING GARDEN AND GREENHOUSE.

Mr. W. A. Ross is carrying on at the present time at London, Ont., a series of experiments on the control of Sow bugs (*Oniscus* sp.) which are particularly injurious to florists' stock in greenhouses. Various kinds of repellents and poisoned baits are being tried, and the effect of soil fumigation and sterilization of the soil is being studied. One of the most important factors in the control, and one which is apparently least observed, is cleanliness and tidiness in and around the greenhouse and the benches.

A series of experiments on the fumigation of greenhouses for the control of White fly (*Aleyrodes*) is also being carried out.

VII.—APICULTURE.

Until the end of September, 1912, the apiary was under the care of Mr. J. I. Beaulne, who had managed the practical apiculture in a satisfactory and successful manner since the summer of 1910. The necessity of extending the apiculture work, and the great need for experimental work on the breeding and nesting of varieties and strains of bees suited to our varied conditions and resistant to disease, resulted in the appointment of Mr. F. W. L. Sladen, as Assistant Entomologist for Apiculture, who arrived in Canada from England in September.

The bees in our apiary were brought out of the cellar on March 27th to 29th. Thirty colonies were put into winter quarters and twenty-seven were taken out, three having been lost, owing to rats, exhaustion of stores and queenlessness, respectively. The average weight of the colonies on being brought out was 33 pounds, and the average loss in weight during the winter was 14 pounds. The summer was unusually wet and cold; nevertheless, the number of colonies was increased to forty-seven by swarming and dividing, and 882 pounds of honey were taken, an average of

32.66 pounds per hive, spring count. There were 750 pounds of extracted honey, the rest being comb honey. Basswood yielded honey for the first time in several years. Traces of European Foul Brood were found in two colonies in June, and the presence of this disease in the Ottawa district necessitated constant vigilance. A demonstration was given by the Provincial Apiarist, Mr. Morley Pettit, in June, and throughout the summer visits were paid to the apiary by farmers and others seeking practical advice.

As a basis for the future breeding work, arrangements were made for Mr. Sladen to bring with him six pure Italian queens from Bologna, belonging to a strain which had been found to be resistant to European Foul Brood in England. Five of these were successfully introduced at the end of September. Further queens are being imported from Italy, Italian Switzerland and the Southern States.

WINTERING OUT-OF-DOORS.

An experiment in wintering bees out-of-doors in special wintering cases was commenced. Three large winter cases, each capable of holding four hives, with a space of 2 to 5 inches around the sides, 4 inches underneath and 10 inches on top, for packing material, were constructed out of 1-inch pine. Owing to the fact that bees consume more food when wintered out-of-doors than they do when wintered in the cellar, especially heavy colonies were selected for the out door wintering, their average weight being 81.5 pounds. Four of the colonies were packed in shavings, four in cut straw and four in clover chaff. Each hive had its cover removed, the frames being covered with a quilt. The winter cases were raised well above the ground and supported on four wooden hive stands.

The placing of the hives in the winter cases and the packing were completed during the second week in November. The bees had a good flight on November 5, a still and sunny day, with temperature 55° F. A fair number flew on November 21, another still and sunny day, with temperature 50° F. On December 9 the flight holes of the winter cases were reduced on the outside to an L-shaped aperture 1½ inches high, and 4 inches long, each arm being from ¾ to 1 inches wide. Such an entrance, while protecting the bees as much as possible from cold winds, cannot easily be choked by dead bees. The winter was unusually mild. A few bees were seen flying from some of the hives on 14th and 18th February, some of them dropping and dying in the snow. On 11th and 12th March, the bees were flying rather freely, especially from the entrances facing the sun; they returned well, very few being lost, though the ground was covered with snow. Up to the time of writing, March 31, the colonies have not been examined, but indications point to the probability that the bees have wintered well.

The thirty-five remaining colonies were put into the cellar on November 8. Their average weight was then 51 pounds. On March 15 the bees appeared to be wintering well, and all the colonies were found to be alive except one, which had no food in its combs, its weight having dropped from 47 pounds on November 8, to 28 pounds, a loss of 19 pounds. No queen could be found among the dead bees.

APICULTURE ON THE BRANCH EXPERIMENTAL FARMS.

Apiculture has been continued on certain of the chief farms of this branch, and the following observations are made in the reports received from Nappan, N.S., and Agassiz, B.C., respectively:—

Nappan, N.S.—Fifteen colonies were taken out of the cellar and put on their summer stands on April 2, 1912. Brood rearing had begun. Until July 22 there was promise of a good season, and some fine clover honey was secured;

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after that date, however, owing to the excessive wet weather, no honey was gathered. Twenty-five colonies were put into the cellar in December. At date of writing (March 31, 1913) ten colonies have been placed on their summer stands.

Agassiz, B.C.—The ten hives are all in good condition, being quite strong, both in stores and in bees. During the past season an average of 25 pounds of honey per hive was secured. Nine of the hives were wintered out-of-doors, and, with the exception of two, came through in excellent shape. The one hive which has been wintered inside for two years does not seem to have any advantage over those wintered out-of-doors. There has been an abundance of food for the bees; the chief honey plant seems to be the white clover, which is more or less constant from the first of June until the first of September. Fair success was obtained this year in keeping down swarms; this, it is believed, was brought about by always allowing plenty of room and fresh air and by occasionally splitting the brood nest.

During the coming year, it is intended to organize and co-ordinate the apicultural work on the Experimental Farms with a view to ultimately maintaining an apiary on each of the Branch Farms. The extension of bee-keeping in western Canada is especially important, and special attention will be paid to this work and its possibilities. In order to stimulate bee-keeping in Canada, and to guide beginners, a bulletin entitled 'The Honey Bee' was written and published during the year, and has already proved extremely useful.

VIII.—MISCELLANEOUS.

COLLECTIONS.

During the year we have continued to name collections of insects for individuals and teaching institutions. Considerable progress has been made in the arrangement of our now rapidly increasing collection of Canadian insects, to which duty Mr. Germain Beaulieu has assiduously devoted himself, with satisfactory results. The Hemiptera have been arranged, and special attention has been devoted to several orders of the Coleoptera. Mr. Beaulieu has undertaken a careful study of the Elaterid beetles, which includes the various species of wireworms. Mr. Sladen has been placed in charge of the Aculeate Hymenoptera and has made marked progress in arranging this group. Special attention is being paid to the *Bombi*, on account of the economic importance of certain species.

In the determination of new material, Dr. L. O. Howard, Chief of the United States Bureau of Entomology, and his scientific assistants in the Bureau and in the National Museum at Washington, have again placed us under a debt of gratitude by their kind assistance, and our very cordial thanks are extended to other specialists who, in like manner, have so willingly assisted us in our work.

An extensive exhibit of injurious and useful insects and their work was made at the Dominion Exhibition, held at Ottawa, in September.

CORRESPONDENCE.

The increase in the work and in the staff of the Division has naturally resulted in an increase in the correspondence. The number of letters received from April 1, 1912, to March 31, 1913, was 5,105, and the number of letters sent out during the same period was 6,938, compared with 3,993 letters received and 5,465 sent out during the previous fiscal year.

TRAVELLING.

Visits have been made to the various provinces for the purpose of organizing and inspecting the field work, and to give lectures and addresses. In May, I visited Nova Scotia, New Brunswick and Massachusetts in connection with our work against the Brown-tail Moth. At the end of July, I left for England and attended the International Congress of Entomology, which was held at Oxford from August 6 to August 10. On August 12, as Canadian representative, I attended a conference called by the Secretary of State for the Colonies at the Colonial Office to work out a scheme for Imperial co-operation in preventing the spread, and furthering the investigation, of insect pests. This conference and a previous conference held in June, 1911, has resulted in the establishment of the Imperial Bureau of Entomology, to which reference is made in the next section. Lectures and addresses have been given at Halifax, St. John, N.B., Toronto, Winnipeg, and other places. In February, a visit was made to North Portal, Sask., and Winnipeg, Man., in connection with the establishment of a fumigation station in southern Saskatchewan, and the annual meeting of the Manitoba Horticultural and Forestry Association at Winnipeg was addressed. Mr. Arthur Gibson lectured at a short course held at Charlottetown, P.E.I. in January, and has addressed other meetings. As I have already stated, Mr. J. M. Swaine has visited different provinces studying forest insect depredations. Mr. F. W. L. Sladen conducted a short course in apiculture at the Nova Scotia Agricultural College in January, and subsequently addressed meetings and studied apicultural conditions in Nova Scotia and New Brunswick.

IMPERIAL BUREAU OF ENTOMOLOGY.

Through the co-operation of the self-governing British Dominions and colonies and the Colonial Office, an Imperial Bureau of Entomology has been established, at the beginning of the present year, in London, England. It is an expansion of the Entomological Research Committee of the Colonial Office, which was established in 1909, and was concerned with the furthering of entomological research in the British possessions in tropical and sub-tropical Africa, especially in so far as it is related to such human diseases as sleeping sickness and malaria, etc. By securing co-operation and financial support of the self-governing Dominions and Colonies, the Colonial Office has been enabled to broaden the work by the formation of this Bureau which is managed by an honorary committee of experts in Entomology, in tropical and veterinary medicine: the chief entomologist of each of the self-governing Dominions is *ex-officio* a member of the committee.

The functions of the Bureau are as follows:—

1. A general survey of the noxious insects of the world and the collection and co-ordination of information relating thereto, so that any British country may learn by inquiry what insect pests it is likely to import from other countries, and the best methods of preventing their introduction and spread.
2. The authoritative identification of insects of economic importance submitted by the Departments of Agriculture and Public Health throughout the Empire.
3. The publication of a monthly journal, giving concise and useful summaries of all the current literature which has a practical bearing on the investigation and control of noxious insects. This journal, entitled *The Review of Applied Entomology*, commenced in January, 1913. It appears in two parts: Series A, Agricultural, and Series B, Medical and Veterinary. As supporters of, and adherents to, the Bureau, we receive a number of copies of this journal each month and these are distributed to the Provincial Departments of Agri-

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culture, the Provincial Entomologists and the libraries of the Universities and Agricultural Colleges. In addition to the *Review*, the Bureau is continuing to publish *The Bulletin of Entomological Research*, containing scientific papers embodying the results of original investigations carried on in the British Colonies.

The problem of the prevention of the spread and also control of insect pests is fundamentally one for international action and co-operative effort. It is, indeed, a most fortunate thing that the British countries have been able in this matter to take advantage of their mutual attachment and interests and to organize in a manner which must ultimately be adopted by all countries of the world, as the prevention of the spread of insect pests with the minimum interference in the interchange of natural products can only be brought about by international co-operation. This is now becoming more generally realized as indicated by the proposal of the International Institute of Agriculture at Rome to form an International Commission to consider the whole subject.

PUBLICATIONS.

The different officers of the Division, both at headquarters and in the field, have contributed scientific papers to entomological and other journals, and more popular articles to the agricultural press. In addition, the following bulletins have been published during the year:—

'The Honey Bee. A guide to Apiculture in Canada,' by C. Gordon Hewitt, 45 pp., 14 figs., (*Bull. 69, of the Experimental Farms Branch*).

'Cutworms and Armyworms,' by Arthur Gibson, 29 pp., 10 figs., 1 pl. (*Bull. No. 70 of the Experimental Farms Branch*).

'The Control of Insect Pests in Canada,' by C. Gordon Hewitt, 13 pp. (*Bull. No. 9, Second Series of the Experimental Farms Branch*).

'The Large Larch Sawfly,' with an account of its parasites and other natural enemies and means of control,' by C. Gordon Hewitt, 42 pp., 21 figs., 4 pls. (*Bull. No. 10, Second Series, of the Experimental Farms Branch*).

'Legislation in Canada to prevent the Introduction and Spread of Insect Pests and Diseases destructive to vegetation, with Regulations regarding importation of vegetation into Canada,' by C. Gordon Hewitt, 36 pp. (*Bull. No. 11, Second Series, of the Experimental Farms Branch*).

STAFF.

The continued increase in our work, and necessary expansion, has necessarily required an increase in the staff of the Division, and the following additions have been made during the past year:—

Mr. F. W. L. Sladen has been appointed Assistant Entomologist for Apiculture. Mr. Sladen was one of the foremost bee-keepers in England and has previously visited Canada and the United States; he has also studied the bees in India. His work on queen-rearing has given him an international reputation and, in addition to his book on *Queen rearing in England*, of which a second edition is now being published, he has published a number of important papers on the pollen collecting habits, etc., of the bees. He has also made extensive studies of the wild bees or *Bombi*, so important in the fertilization of certain of our clovers, and the results of his investigations have been recently published in volume form in his book, *The Humble-bee, its Life History and how to domesticate it, with descriptions of all British species of Bombus and Psithyrus* (Macmillan & Co.). Mr. Sladen's appointment has

given very great satisfaction to Canadian bee-keepers and the great necessity for the extension of apiculture in Canada affords him an unrivaled field for good work.

Mr. H. F. Hudson, B.S.A., has been appointed a field officer of the Division. Mr. Hudson was born in England and graduated at the Ontario Agricultural College, Guelph. Subsequently he joined the staff of Dr. S. A. Forbes, State Entomologist of Illinois, in which position he remained up to the time of his appointment to our service.

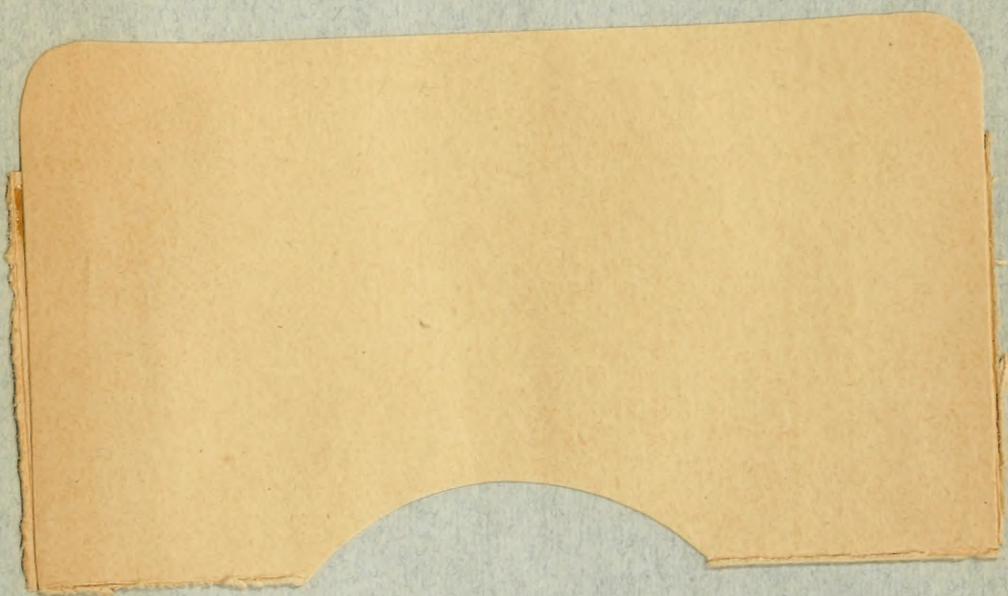
Mr. C. E. Petch, B.S.A., was appointed a field officer of the Division in June, 1912. Mr. Petch graduated at the Ontario Agricultural College.

Mr. E. H. Strickland was appointed field officer of the Division in March, 1913. He received his entomological and agricultural training at the Southeastern Agricultural College, Wye, England. In 1910, he was selected by the Colonial Office as a Carnegie Scholar, and spent the years 1910-11 in the United States studying the methods of insect control, under the United States Bureau of Entomology, and carrying on special studies at the Bussy Institution of Harvard University, under Dr. W. M. Wheeler. He will undertake cutworm investigations in Alberta.

The progress and success of the work of the Division has been due to the loyal assistance which all the officers of the Division, both at headquarters and in the field, have rendered. To my chief assistant, Mr. Arthur Gibson, who has had charge of the Division during my absence and has superintended the fumigation and inspection work in addition to the general work of the Division, my especial thanks and acknowledgments are due. Miss J. McInnes and Mr. J. A. Letourneau, with temporary assistance, have conducted the secretarial work to my great satisfaction. It would be impossible to find a staff more devoted to their work than the one I have the privilege to direct, and their zeal is a great inspiration. The territory which we have to cover is only equalled in extent by the infinite variety of problems requiring attention. Gradually, we are taking hold of the more pressing matters for investigation and, as the service is extended, the utility of our work and the assistance we are able to render increases in a greater proportion. I only regret that we cannot directly answer more of the calls for assistance.

I have the honour to be, sir,
Your obedient servant,

C. GORDON HEWITT
Dominion Entomologist.



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