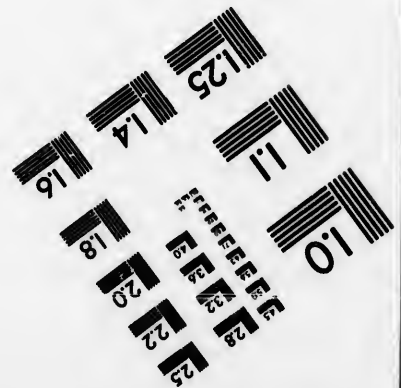
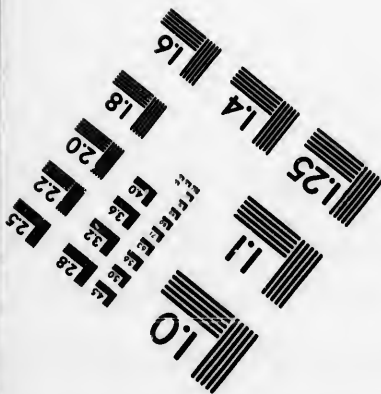
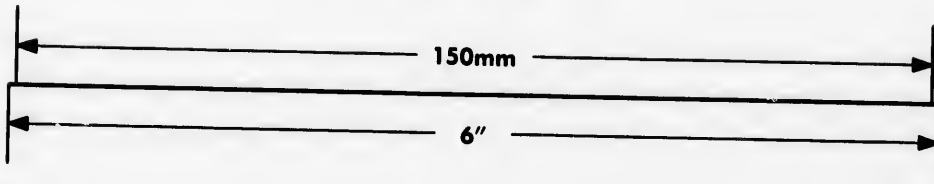
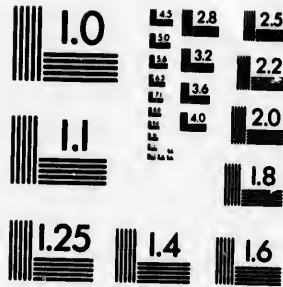
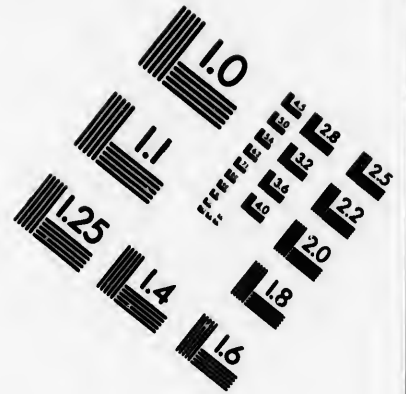
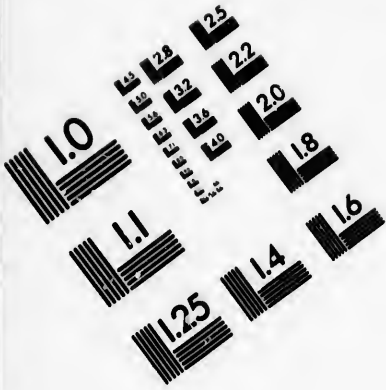


IMAGE EVALUATION TEST TARGET (MT-3)



APPLIED IMAGE, Inc
 1653 East Main Street
 Rochester, NY 14609 USA
 Phone: 716/482-0300
 Fax: 716/288-5989

© 1993, Applied Image, Inc., All Rights Reserved

**CIHM
Microfiche
Series
(Monographs)**

**ICMH
Collection de
microfiches
(monographies)**



Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques

© 1993

Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

Coloured covers/
Couverture de couleur

Coloured pages/
Pages de couleur

Covers damaged/
Couverture endommagée

Pages damaged/
Pages endommagées

Covers restored and/or laminated/
Couverture restaurée et/ou pelliculée

Pages restored and/or laminated/
Pages restaurées et/ou pelliculées

Cover title missing/
Le titre de couverture manque

Pages discoloured, stained or foxed/
Pages décolorées, tachetées ou piquées

Coloured maps/
Cartes géographiques en couleur

Pages detached/
Pages détachées

Coloured ink (i.e. other than blue or black)/
Encre de couleur (i.e. autre que bleue ou noire)

Showthrough/
Transparence

Coloured plates and/or illustrations/
Planches et/ou illustrations en couleur

Quality of print varies/
Qualité inégale de l'impression

Bound with other material/
Relié avec d'autres documents

Continuous pagination/
Pagination continue

Tight binding may cause shadows or distortion along interior margin/
La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure

Includes index(es)/
Comprend un (des) index

Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/
Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.

Title on header taken from:/
Le titre de l'en-tête provient:

Title page of issue/
Page de titre de la livraison

Caption of issue/
Titre de départ de la livraison

Masthead/
Générique (périodiques) de la livraison

Additional comments:/
Commentaires supplémentaires:

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X	12X	14X	16X	18X	20X	22X	24X	26X	28X	30X	32X
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The copy filmed here has been reproduced thanks to the generosity of:

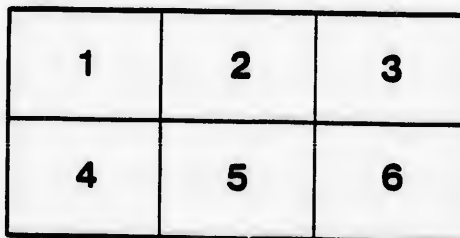
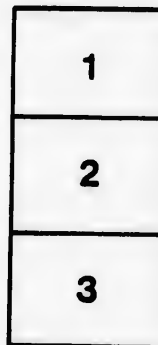
Library
Agriculture Canada

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shall contain the symbol \rightarrow (meaning "CONTINUED"), or the symbol ∇ (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:



L'exemplaire filmé fut reproduit grâce à la générosité de:

Bibliothèque
Agriculture Canada

Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole \rightarrow signifie "A SUIVRE", le symbole ∇ signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.



1891

HOUSE OF COMMONS OF CANADA.

EXAMINATION

OF

MR. JAMES FLETCHER,

ENTOMOLOGIST AND BOTANIST

TO THE

DOMINION EXPERIMENTAL FARMS,

BEFORE THE

SELECT STANDING COMMITTEE

ON

AGRICULTURE AND COLONIZATION,

4th July, 1891.

PRINTED BY ORDER OF PARLIAMENT.

CONTENTS.

—0—

Average loss of farm crops by insects.....	3
Local outbreaks of pests produced by local causes.....	3
Classification of insects—Life—History of.....	4
A knowledge of lives of insects necessary to successful treatment	5
Enormous losses by insect ravages to farm crops in various parts of the U.S.....	5
Materials and apparatus prescribed for treatment of various kinds of insects—Life course of each kind described.....	6, 13
Fungous diseases of fruits—Black spot—Mildew, and remedies for.....	10
Potato rot—A successful remedy for.....	11
Fodder grasses, properties and cultivation of.....	11

HOUSE OF COMMONS,
COMMITTEE ROOM No. 46,
SATURDAY, 4th July, 1891.

The Select Standing Committee on Agriculture and Colonization met this day at 11 a.m., Mr. SPROULE, Chairman, presiding.

Mr. JAMES FLETCHER, Entomologist and Botanist of the Dominion Experimental Farms, being called for examination, said:—

Mr. CHAIRMAN,—I do not intend to begin with an apology, but I should like to give an explanation why, perhaps, I am not so well prepared to-day, as I might have been, to give you a comprehensive statement of the work that I have been doing during the past year, or as regards future work, and what may be considered the ultimate result of that work in connection with the Experimental Farms. The notice of to-day's meeting I only received this morning, in town, ten minutes after the time I ought to have been here in attendance on the Committee; consequently, I have not with me the notes I had prepared so as to give you a concise and systematic statement, nor have I some specimens of grasses and a spraying pump which I wished to have exhibited. Nevertheless, I shall endeavour to give you an outline statement, which I trust will be of interest to you and which will show, in some measure, the work that has been carried on.

The department of the Experimental Farm work, of which I am in charge, includes the divisions of Entomology and Botany, and these, to my mind, are second to none in importance of any work that has been carried on by the Government on the Experimental Farm. The interests at stake are so large, reaching to at least one-tenth of all crops grown, and the measures to be adopted to reduce the injury and loss to the country are so simple, and yet so important, that the only requisite is a knowledge amongst farmers of how and when to apply remedies. Therefore, it becomes necessary to make known, as widely as possible, throughout the country, to farmers and others interested, the nature of this important work which is being carried on for their benefit. I know of no way of accomplishing this with better effect than through the instrumentality of this Committee and of its individual members. I was, therefore, greatly pleased to receive the summons to come before it again, as I used to do regularly, until two years ago. Also, I appreciated the compliment to the work I have been carrying on, and am glad of the opportunity of bringing the importance of it before you to-day. I shall, during the short time I address the Committee, endeavour to give as concise an account as possible of this work.

Average loss
of crops, by
insects.

Our annual reports issued by the Department are necessarily condensed, and the amount of space that it is possible to devote to any one department is much smaller than serves to report even the outlines of all the different investigations that are being prosecuted. All that is possible is to give the most important records and those that we consider of the widest utility to farmers of the Dominion. There are certain local outbreaks of a destructive character, due to insects or fungi, results of local conditions and susceptible to local applications, and it is generally inadvisable to devote any large portion of the annual report to local incidents of this nature. But we issue bulletins, when necessary, to meet such cases as I have

Scope of
reports.

Importance of
the Commit-
tee's work.

mentioned, and the newspapers all over the country have been always most courteous, and have published promptly any letters or suggestions that I have found it advisable to put forth, and thus I have been able to relieve many farmers whose crops were being injured. But I know of no better means of disseminating information than are afforded by this Committee, whose members pay especial attention to agricultural questions, and who, coming from all parts of the Dominion, are through their constituents brought into contact with a large number of men who are specially concerned in the results of our experience and observation.

Classification
of insect pests.

The first and most important part of my work, and that to which I shall, probably, devote the whole of my attention, before long, is Entomology. The two divisions, Entomology and Botany, have now become so large that they each require, the attention of one man. In the beginning of this season I applied to the Honourable Minister of Agriculture to be allowed to issue bulletins regarding the most injurious insects and fungous diseases of plants, which farmers have to contend with,* and shortly afterwards issued a bulletin in which I treated of the insects which had been most frequently complained of by my correspondents. In speaking of the various injurious insects, it is convenient to divide them under three heads—first-class, second-class and third-class pests. The first-class pests are those that every farmer should know something about. They are the most frequent and destructive, and should he lack the knowledge or be unable to apply the remedy he is apt to lose a large proportion of his crop every year. In the second class are those that, while they are injurious when they occur, do not occur every year, and whose multiplication is due to exceptional circumstances. The third-class embraces those which seldom occur in large numbers and do not occasion severe loss. Now, it is not necessary for the agriculturist to direct attention to the whole of these, and I should say that there are only about fifty insects that the farmer need bother his head about. In this bulletin, copies of which I have placed on the table, are given the general rules upon which we apply remedies to check the ravages of injurious insects. Everybody must recognize the enormous damage that some of the most important crops of our country sustain through the injuries of insects; but everybody does not know that the remedies for these injuries are simple and can be easily applied. Systematic observation and study have taught us that the injuries are done in two ways—either by the insect consuming the substance of the plant, or by the juice being sucked out of it and the plant thus left to wither. These two kinds of injuries are due to the fact that the mouth parts of insects are either in the form of biting jaws or of a hollow tube. Those possessing the first kind of mouth parts masticate solid food, while the others subsist upon liquids as sap. The remedies for these two classes of insects are quite different, and this shows the great importance of knowing the life history of insect enemies. As an illustration of this fact, here is an insect which has been brought here this morning by a member, to be identified. It is the American silk worm moth, (*Telea Polyphemus*). Now, if this were submitted to an Economic Entomologist as an injurious insect, and he did not know its life history, it would give him food for thought, and it is such as these we must make use of for experimental purposes. Here is an insect which

Biting insects.
Suckling in-
sects.

A knowledge
of life history,
necessary for
successful
treatment.

*The bulletin referred to here and in pages following is Central Experimental Farm Bulletin, No. 11, intitled: "Recommendations for the prevention of damage by some Common Insects of the Farm, the Orchard, and the Garden," by James Fletcher, Entomologist, published by the Department of Agriculture in May, 1891.

is actually without a mouth at all. In its perfect state, as I hold it in my hands, it has no mouth at all. It has no means of taking nourishment. The nourishment it needed to support this large body was taken in while it was a caterpillar. The eggs are laid on various trees, amongst others, oaks and maples. In the caterpillar state it lives for a few weeks, and consumes all the food it requires. It then spins a silken cocoon and remains in a torpid state as a chrysalis, until the next June, when it emerges in its perfect state, as a beautiful moth. The only object of its existence now is to find a mate and lay its eggs so as to prepare for a future generation. As I have said, this moth has no mouth, and therefore the methods used to catch some insects, such as the moths of cutworms, which may be attracted in large numbers at night by molasses spread on boards, would be of no use. It is necessary, in seeking for remedies, to know something of the life history of the insects causing the damage. This sometimes takes a considerable amount of time and needs steady application. By following the advice of Economic Entomologists, farmers and others are saved a considerable portion of their produce every year; for the life histories of many of the insects which are most injurious are already studied out, and to-day I believe it is not too much to say that any farmer who will apply to the Experimental Farm for information concerning insect injuries, can get, simply for the asking for it, advice which will save him much loss; and this with regard to almost any insects to which he may refer. In this bulletin which I have issued there are 36 insects treated, and these include all the worst pests which have been referred to me since I came to the farm at Ottawa. I restricted myself to these so that I might keep the bulletin small. I think it covers most of the kinds from which the farmer need apprehend serious annoyance or injury. In the first part are given general statements with regard to the different kinds of injuries and the nature of the insects causing them, the different kinds of remedies and the way to apply them; also, mention is made of some of the best kinds of spraying apparatus. The end in view in publishing the bulletin was to give farmers a simple and easy source of reference, and I believe it is so written that any farmer in the country will understand every word of it.

Economic value of entomology to farmers.

In regard to the injuries done by insects, I have already laid before this Committee, Mr. Chairman, a general statement as to the amount of the injuries, but it may not be amiss to read you a short paragraph from *Insect Life*, a magazine issued by the United States Department of Entomology. And, by the way, I may state that that Department has now come to be recognized as of such importance that it is necessary to publish this magazine every month. It is read by thousands of people all over the world. It is distributed in very large numbers amongst the farmers who apply for information concerning injurious insects, so that the officers in charge adopt this means of answering their correspondents and making the results of their experiments known to all interested. In this issue we find an answer to some one who writes to the U. S. Entomologist asking for facts regarding the money value of the crops annually destroyed by insects.

We find that in the year 1854 the wheat midge destroyed, in the State of New York, no less than \$15,000,000 worth of wheat. In 1867, in the State of Illinois, the chinch bug destroyed \$73,000,000 worth. For hundreds of miles the crops were swept away by this terrible pest.

Enormous losses by insects.

By Mr. Trow:

Q. Do you mean that the whole crop of Illinois was swept off for hundreds of miles?—A. Yes, sir. Nearly the whole crop of the State

was destroyed. Dreadful havoc was again made of the crops in the United States in 1874, when the damages from the Rocky Mountain locust were estimated at \$100,000,000 in the four states of Kansas, Nebraska, Iowa and Missouri.

Q. What are you quoting from?—A. '*Insect Life*,' the monthly magazine published by the United States' Department of Agriculture, Division of Entomology, at Washington. These figures have been frequently quoted and challenged, and as frequently confirmed.

Q. It includes the corn crop, I suppose?—A. Yes; cereals of all kinds. The general estimate of damage in the United States from the chinch bug, in 1887, was \$60,000,000, and it is estimated that the total loss every year is between \$200,000,000 and \$300,000,000. These figures have been carefully made up on the lowest possible computation. There is no doubt, as I have said, that at least one-tenth of the whole of the crops produced is lost every year through the attacks and injuries of insects, and I have no hesitation in saying that a very large proportion of this could be saved every year by the adoption of simple remedies, if the farmers would only take the trouble to find them out. At the present time, I am glad to say, our farmers are taking this trouble, as testified by the correspondence in my department, which is now very large indeed, farmers in every province utilizing the services of the department in this manner. Therefore, it gives me very much pleasure to come before this Committee, whose members frequently learn of injuries to crops in their constituencies, extending over districts in Canada to which I have had no opportunity of giving attention, and I shall take it as a great favour if members, whenever they hear of injuries of this kind, will write and let me know, so that I may investigate the matter. Members of Parliament often do me and the country great service in this way. I am dwelling at some length on this, because I wish to impress upon you what I myself know to be the case, that these studies are of enormous importance if we get agriculturists, gardeners and others to apply them and put them into practice. In the bulletin which I have already referred to I draw attention to some of the most commonly occurring insects all over the country. Now, Mr. Chairman, with your permission, I am going to speak of one or two of these, to impress upon the members that these studies are of the value I claim for them. A general truth requires an illustration to bring it home to ourselves. The general truth that the injury is great will be acknowledged by all, and I purpose to refer to the treatment advised for three or four of our worst insect enemies, to illustrate that economic Entomology has provided us with means for averting much of this injury. There is probably no farmer who has grown turnips who has not suffered from the turnip flea beetle, or "turnip fly," and who is not familiar with its destructiveness. Yet this is an insect which is very easily dealt with indeed. It is a very general practice for good farmers, all over the country, to apply gypsum, or land plaster, to the young turnips, as soon as they appear above the ground. This is done to provide the plant with a quick-acting fertilizer, and this is frequently done so as to enable the plant to outgrow the attacks of the flea-beetle, and it very frequently fails in this object; but if we mix with the gypsum some Paris green (1 pound to 50), there is no more labour required to apply the mixture, but at the same time the turnips are helped, the insects are destroyed and the crop is no longer checked. Another remedy, the result of experience and observation, is choosing the proper time for sowing turnips, so as to escape the different broods of this insect. There are two or three broods in the year. It is not confined to turnips, but attacks several

Recipes for
treatment of
some well
known in-
sects.

The turnip
fly.

plants belonging to the same natural order, as cress, wall-flowers, cabbages, &c. It appears with the first warmth of spring. The reason of this is that it passes the winter in its perfect state. It feeds on cruciferous plants then in leaf, copulates, and lays eggs for another brood. From about the 15th to 30th of June we see very few of these turnip fleas. This then is the best time to sow. The reason these small beetles are so injurious is that they attack the turnips when they can least stand it, when they are young, and they take the food which is provided in the seed leaves for the young plant.

Q. What influence has Paris green when it is put in with the seed?—A. It would not do to sow it with the seed. It would check the seeds in germinating, and would have no effect on the insects. What is necessary is to dust the plants with a thin film of powder containing Paris green—a very light sprinkling is sufficient. This can be applied by putting the powder in a small tin canister with a perforated top. Have this fastened to a short handle, and then distribute it by shaking it over the plants. Another and more simple contrivance is to put the powder in a small bag of muslin, hung by a short string to a handle, and tap the bag with a light stick. The reason for tying it on a string is that it makes a great difference to the person who has to apply the poison. If you have to stoop down for a long time in walking along the rows, it very soon becomes exceedingly tedious and painful. By tying the bag to the end of the handle it can be held easily at the proper height by a person walking upright.

I will now pass on to another illustration. Anyone who has a farm or a garden must too often have suffered from the attacks of some of the numerous Cut-worms, which are very injurious from one end of the country to the other. I have had numerous inquiries this year concerning these insects from all parts of Canada, from farmers, gardeners and others. Lately the President of the Board of Trade at Lethbridge, N.W.T., telegraphed to know what to do to stop their ravages in garden crops.

Cutworms.

Q. These are not the wire-worms?—A. No, sir; these are grey caterpillars, which cut off many kinds of plants, close to or just beneath the surface of the ground, particularly young tomatoes and cabbages, when they are planted out in the spring.

By Mr. McMillan:

Q. And Indian corn?—A. Yes. Indian corn is destroyed sometimes, but not so often in this locality as other plants, perhaps every three or four years; but cabbages and tomatoes are destroyed every year. Indian corn, however, is destroyed by cut-worms in certain districts much more than in others. The most applicable remedy for fields of Indian corn would probably be poisoned traps—that is, bundles of loose herbage tied together, dipped in Paris green and then distributed about the fields at, say, fifteen or twenty feet apart. The habits of most of these insects are as follows:—The young caterpillar hatches from eggs, laid about August or September of the year before its ravages are noticed. It feeds upon various plants in the autumn, and then its ravages pass unnoticed, because there is a large amount of vegetation. It passes the winter in a torpid state, and in the spring comes forth and destroys the farmer's crops. After the winter all vegetation is cleared off the surface of the fields. The farmer then puts in his crop, and the only vegetation above the ground is what the farmer has planted; this the cut-worm eats. Now, if you forestall the cut-worms and give them food in the shape of these poisoned bundles before the new crop comes up, they will poison themselves and the crops will be saved. I have frequently observed the utility of these traps on different fields. Mr. Craig our

Horticulturist, had a field of tomatoes and cabbages, this spring, which was planted on a piece of land which was found to be badly infested by cutworms. He had several of these traps put out, and the insects fed on them and were destroyed by the Paris Green, but hardly any of the plants he set out were cut down. In very hot weather it is advisable to put shingles over the traps, to prevent them from fading too soon. They will thus last for four or five days.

Q. How do you apply the Paris green?—A. The easiest way is to mix it with water and add a little soap, then sprinkle it over the bundles or dip them into it. If you mix soap with the water you will find that it will adhere much better to some vegetation than if water alone is used. Of course, care must be taken to put down a sufficient number of bundles; I believe if they are put even twenty or thirty yards apart it will be found sufficient in most cases.

By Mr. Bowers :

Q. All these cut-worms don't commence at the fall of the year, do they?—A. No; but I think that most of them do. There are no less than three hundred different moths, the caterpillars of which are known as cut-worms.

Q. We never see them before the crops are come up. They are grey worms, about an inch and a-half long?—A. There are a great many different kinds of cut-worms, and they vary somewhat in their habits, and some varieties are much more troublesome than others.

Development
of insects
affected by
the weather.

Q. I find that those I speak of commenced their ravages about the first of June, when I was home, just after Sir John Macdonald's death?—A. The habits and development of insects are modified by the weather. The greater number of cutworms hatch in late summer and begin their growth in the autumn, pass through the winter as half-grown caterpillars, and then complete their growth in the spring. There are some kinds, also, which pass the winter as eggs or in the perfect state as moths which lay eggs in the spring. A remedy for those which hibernate as caterpillars is late ploughing. They pass the winter in little cells beneath the surface. Late ploughing breaks these up and exposes the caterpillars to the elements. Clean farming and seeing that the weeds are all kept down late in summer, also prevent the mother moths from laying eggs, because they will not lay them where there is not suitable food for the offspring. There is, again, another very simple remedy which is very little trouble. It is simply to wrap around each plant a piece of paper such as I have here, two and a-half inches by three inches; the paper can be tied up in little bundles and hung from the side of the basket in which the young cabbages are carried to the field, and as you take each cabbage from the basket put the paper round the stem, then as you put the plant into the ground you hold the paper round it, and cover it up, leaving about one and a-half inches of paper above the ground.

Q. I got tins made. How do you regard them?—A. If you go to the expense of tins, it is of course so much the better, because the cut-worm cannot climb up the smooth surface and the tin bands will last for many years. This remedy is not, of course, perfectly infallible, but often a very little trouble will save a great deal of the mischief that would be done if things were left alone.

Q. We had a considerable deal of corn that the cut-worm eat off last year. We had 14 acres, and there were 3 acres in which it cut off one-third of the corn?—A. Did the insect cut it off, or bore into the stem?

Q. Oh, it cut it off. I found little worms in each recess that was cut. They may be different from the others?—A. These would be

some late kind of cut-worm, and the most applicable remedy would probably be the traps mentioned—at the time the corn would be as high as you mention, there would be a good crop of clover—it would be well to cut off a quantity of the green clover, spray or sprinkle it with Paris green, and having loaded it on a cart, drive through the field and distribute it through the crop by means of a pitchfork.

There are one or two other insects I wish to speak of. I would like to speak about the troublesome plant-lice or "green flies," which affect different kinds of plants, and have always been troublesome for the Entomologist to combat satisfactorily. The most useful remedy is an application of the kerosene emulsion—a mixture of two parts of coal oil and one of soap and water. Churn these for some time with a syringe, and then you get an emulsion like cream. If you mix this with nine times the quantity of water you will find it an efficient remedy for all kinds of plant lice.

Plant lice
(Aphis)

By Mr. Bowers :

Q. Would not this destroy the rose-bug?—A. It would do so if it were sprayed right on to its body. Some insects are more difficult than others to destroy, and the rose-beetle is one of the very worst. I shall now speak for a few moments of scale insects.

By Col. O'Brien :

Q. I had, I may say, a crop of turnips killed by aphid?—A. On a dry knoll on the experimental farm some years ago we also had some plants attacked by it.

Q. I find the aphid is a hard enemy to deal with?—A. It is, undoubtedly; but the kerosene emulsion will conquer it. This must be distributed by means of a proper nozzle; the best is the "Riley Cyclone Nozzle." It is called the Riley or Eddy Cyclone Nozzle, and by its means a very little liquid can be pumped upon the plant and falls as a fine mist. These nozzles are very necessary for the application of remedies to such plants as cabbages or turnips, which grow low and are attacked beneath the leaves. The turnip aphid does not occur very often. In Bruce peninsula last year it was very troublesome. Three years ago it was troublesome here, and in Hamilton two years ago.

I will now speak for a few moments on scale insects. These have been studied at Washington and here for a number of years, and it is found that the best system of treating them is to deal with them in the spring before the leaves are out. Although they are protected by a waxy scale which covers the whole insect, it is vulnerable to a wash or spray of kerosene emulsion, or coal oil diluted as before mentioned. The life history of the apple-scale is this: Its actual life begins about the first of June, when active little mite-like creatures hatch from the eggs which have passed through the winter beneath the scales on the bark of the apple trees. For a few days they are active, and have six legs, with which they crawl up to the new wood; they then pierce the young bark with their beaks and remain stationary for the rest of their lives. After taking their position, within three or four days, a waxy secretion begins to form, which gradually envelops the whole body, increasing with the insect. In about three months the insect has assumed the form of a scale, with a mass of eggs beneath it. The eggs are very numerous, and after being laid, remain unchanged for nearly nine months, till the next spring. The females of many of the scale insects and plant-lice produce eggs which hatch without any communication whatever with the males. I do not think it is necessary for males of scale insects to have connection with the females for the latter to produce eggs and to carry

Habits of
scale insects.
Phenomenal
propagation.

on generation, there are so few males in comparison with the females. Sometimes, after carefully examining a tree, you will not find one male to a thousand females.

Q. They must naturally have some connection?—A. Not necessarily. It appears in some insects, as, for instance, some saw-flies, they have been known to produce young without the males being known. This is the case, Dr. Packard says, of the gooseberry saw-fly, and although the larch saw-fly has devastated thousands of acres of tamarac swamps, and the females may be caught by the millions, I have never seen a male. There is a process which takes place amongst plant-lice called gemmation or budding. Only in the last brood in the autumn of the apple aphid are males produced. Although there may be twenty generations during the summer, it is only in the last that males are produced and copulation takes place. Eggs are then laid, and in this state the winter is passed. Early the next spring plant-lice hatch from these eggs, which are mature in a few days, and give birth to four or five young every day while they live. These again are ready to have young in four days, and so on throughout the summer; but there are no males till the autumn. This process is analogous to budding in plants, and is called gemmation or parthenogenesis, which means birth from a virgin.

Fungous diseases of fruits, remedy for.

Another important branch of my work at the Experimental Farm has been the study of fungous diseases. The experiments are of more recent origin, and consequently the study of fungous diseases has not developed so far as economic entomology. The instruments necessary are very expensive. It requires a good microscope for examining the different diseases, and special apparatus and books which I have not at the farm. The work has, therefore, been pushed more in other branches for the present, but there are certain fungous diseases which have demanded attention. Amongst these, and upon which Mr. Craig, the horticulturist, has published a bulletin, is that termed the Black Spot of the Apple, a disease due to a parasitic fungus, which can be reduced very materially if people will but follow the directions given in that bulletin. The disease can be very easily treated, sufficiently well, at any rate, to increase materially the value of the crop by the expenditure of a few cents to each tree.

The value of the apples treated may, as a matter of fact, be always increased to more than double what they would have been without treatment. The mildew of the grape, which has been a great trouble to grape growers, and has done great injury in the Southern States, has, within the last three or four years, come into Canada, and as it may unless checked give us a great deal of trouble for a good many years, it has been thought well to try experiments for controlling it. We have been able to take advantage of the studies of Professor Scribner and Mr. Galloway, of Washington, and the results they have arrived at. The treatment recommended for this is: Carbonate of copper, 2 oz.; ammonia, 1½ pints to 25 gallons of water. Three or four applications, two weeks apart, sprayed over the vines from the time the flowers show. With regard to some diseases, as rust of wheat, oats, &c., we are not much further advanced towards a remedy than we were a hundred years ago. We know the life history of the plants; we know the various stages of its growth, but so far no satisfactory remedial treatment has been hit upon.

By Mr. Trow:

Q. Has not the state of the weather much to do with the rust?—A. It has a good deal to do with the development, but not with the actual origin of the rust, which is derived from minute spores, each one of which is capable of producing disease in the plant, upon

which it is parasitic, and which was produced by a plant similar to itself previously. I am sorry to say that the muggy, warm weather we are experiencing at the present time will probably do much harm to the magnificent crop of this year. The rust is just starting now, and I fear, unless we get some dry, windy weather, we shall suffer greatly from rust.

A serious plant disease that has now been brought considerably within control, through the studies of scientific men, is the potato rot. The experiments in connection with this murrain which has caused more than one famine in Ireland, have been most satisfactory, and consist of treating the plant with copper mixtures. What is known as the Bordeaux mixture has been used extensively in France, and this year I read that the English Government is trying it both at home and in Ireland. In the United States it has also been used successfully at some of the experimental stations. I have arranged a series of experiments at the farm for treating both the scab and the rot of the potato. The Bordeaux mixture consists of 6 pounds of copper sulphate dissolved in 16 gallons of water, and 4 pounds of fresh lime dissolved in 6 gallons of water—dissolved separately, but afterwards strained and mixed, and then sprayed over the foliage. For the treatment of the potato beetle and potato rot at the same time, the article known as "London Purple" is to be used for mixing with the Bordeaux mixture, in preference to Paris Green, on account of its chemical nature.

Potato rot.
A successful
remedy for.

In my last annual report it may be noticed that much attention has been given to cultivation of the different fodder grasses. Those experiments have been taken up, I may say, with one special object in view, and that object has been this: All through the Dominion, farmers have been buying at high prices mixed grasses and permanent pasture mixtures, which are sold at these high prices on their English reputation. There is hardly a seedsman in Canada—in fact I do not know a single one—who grows in Canada the seeds he offers for sale. They get their supplies from English houses, which again, in many instances, obtain their seeds from the mountains in Germany, the collectors being small farmers or children who live in the mountains and have no special or technical knowledge. They might, therefore, mix a dozen different kinds of grass seeds, some good, others useless, which would be sold under one name. In cases where the English seedsmen grow the grasses in the English climate for cultivation there, they may give satisfactory results; but I maintain that in many instances English grown seed is not suitable for this climate. This spring I found on my grass plots that many of the varieties reputed to be most valuable, and, in fact, the most important of all the English pasture grasses, could not stand our Ottawa climate. With few exceptions they had been winter-killed, yet those very grasses form the bulk of the seeds that the seedsmen of Canada are selling at high prices, in some cases at \$10 or more per bushel. They sell them in Canada for the same purposes and for cultivation in the same soils as they are recommended for in the English catalogues, while, as a matter of fact, they may be altogether unsuitable for cultivation here in our climate. You may ask what can we get instead. Well, we have native grasses here which are very valuable, and, I believe, are much better suited to our requirements, and I am endeavouring to prove this at the Experimental Farm.

Fodder
grasses.

By Col. O'Brien :

Q. Have you ever tried Italian rye grass?—A. Yes; I have tried it here three years running, in different soils, but it always kills out in the winter. Another grass which will succeed in some parts

of Canada, but has failed with us at Ottawa—at least is not sufficiently hardy to make it a paying crop—is Orchard Grass.

Q. I do not value the Orchard Grass; it is defective in nutritive qualities?—A. If you go down to the Eastern Townships you will find it growing plentifully, and it is of great service as a variety in pastures; this makes it acceptable to stock. I have here a sample of the Meadow Fescue Grass; this is perhaps the best of the English grasses I have tried at Ottawa. The sample I have here is from a bed sown over three years ago. On good soil this grass will give a very heavy crop of hay and pasture. This has been grown on poor soil, with hardly any manure. Here is a grass called the Canary Reed Grass. The seed of this actual sample came from Germany, but it is found wild on low ground and along streams in all parts of Canada from the Atlantic to the Pacific.

By Mr. Trow:

Q. In experimenting upon these grasses, do you know their fattening qualities; that is of importance as compared with the clover and timothy?—A. Yes; they are all being analyzed by the Chemist, Mr. Shutt, and the results are generally good. Had I known earlier this morning, when I left the farm, that I was to appear before this Committee, I should have brought some more varieties with me. The Canary Reed Grass is a grass that grows naturally on wet soil, but will also thrive on dry ground. It is of great value as a green crop. In the beginning of June it will give more green feed than rye. Last year the experimental patch of this grass was cut three times, but it was a mistake cutting it three times, twice would have been better. I consider it one of the most valuable native grasses we have.

By Col. O'Brien:

Q. Is it nutritive?—A. It is, and it is also very palatable, which is a very important factor in feeding, because, however nutritive a grass may be, it is not of much value if it is not palatable, for the cattle will not eat it. The object in a good mixture is to have grasses of nutritive and palatable qualities, and at the same time to get a good yield. One of the grasses that does not stand the winter well with us is the Sweet Vernal Grass, highly valued in England for its earliness and aromatic odour. We have, however, in our native Holy Grass, a grass with both of these qualities, and one which gives much more feed, is very hardy, and grows anywhere from the mountain tops down to the marshes.

By Mr. McMillan:

Q. A great deal depends upon getting early grass; I suppose the native grasses spring up early?—A. Yes, sir; as a rule much sooner than the introduced grasses.

I am afraid, Mr. Chairman, I have taken up more of your time than I ought to have done. I thank you for your attentive hearing.

By Mr. Trow:

Q. I would like to ask Mr. Fletcher what treatment he recommends for scab on the apple?—A. The treatment Mr. Craig recommends in our Bulletin No. 10 is the ammoniacal copper carbonate treatment, which is, I think, quite satisfactory.

By Mr. McMillan:

Q. This disease is a serious matter. Where is it most prevalent?—A. It is in all parts of Canada, varying in prevalence with different seasons. In Prince Edward County last year, I do not think you could find a dozen apple or pear trees where it did not exist. You could see the black spots on the leaves and fruit everywhere, and the fruit was much destroyed. Where the disease is observed, the

leaves should be destroyed by burning in autumn, and the tree sprayed when bare with a sulphate of copper solution, in addition to the treatment of the fruit in summer.

Q. I had a pear tree last year on which the fruit got a little hard and crumpled. First of all it became rough, and then the fruit cracked?—A. Yes. That is another disease, and is the same as the Leafblight of the quince. It is not a disease that is very prevalent in this part of Canada, but down in Nova Scotia and towards the coast it is not uncommon. This has been successfully treated with the Bordeaux mixture I have already described.

By Col. O'Brien :

Q. In speaking about grasses, have you tried any experiments with the native clover? This year has been a wonderful year for clover with us?—A. It was too dry early in the season in many parts. We have no native clovers in this part of Canada; they are all introduced. On the Pacific Coast there are several, some of which are of economic value. The small White Dutch, the Alsike and the red clovers are all introduced. Different seedsmen have sent out special varieties, but they are nearly all produced from these. There are some fine varieties known as mammoth clovers.

Clover not a native of Canada.

Q. I think you find the Dutch Clover everywhere?—A. Yes; but it has always been accidentally introduced. You also find timothy everywhere. I have found white clover in places where I hardly ever supposed it could be carried by artificial means, high up on the Rocky Mountains.

By the Chairman :

Q. You have spoken of the caterpillar pest; what do you think the best means of treating it?—A. Upon what plants?

Q. The plants that it affects most?—A. There are very many different kinds of caterpillars with different habits. One of the most troublesome caterpillars this year is the Canker worm, on apple trees. Of all the different remedies, I think Paris Green the most effective. The Canker worm on apple trees is a source of great trouble. In Nova Scotia they have to fight it every year. It attacks many other kinds of trees besides the apple. In Winnipeg this year it has done much injury to the ash-leaved maples in the streets. Paris Green must, of course, be used with great care. If put on too strong it will injure the foliage, and if applied when apple trees are in flower, the bees which fertilize the flower, will be poisoned. There are many remedies for injurious insects, some practical, others not. A class of remedies which I have always found quite impracticable are the hot water remedies. They are too expensive, to begin with, and it is too difficult to get the water on to the insects at a temperature which will kill them and not injure the plant. It is expensive, because you must have the supply close to where it is to be used, and this frequently means the cartage of both fuel, water and cauldron.

Apple caterpillars, remedy for.

Impracticable remedies.

By Mr. Trow :

Q. Do you approve of scraping the trees with a hoe and putting on white-wash?—A. Yes; I think it is a good plan.

Q. At what stage of plant life would you use gypsum for the turnip flea?—A. Directly the two heart-shaped seed leaves appear.

Having examined the foregoing transcript of my evidence, I find it correct.

JAMES FLETCHER,
Entomologist and Botanist,
Dominion Experimental Farms.

