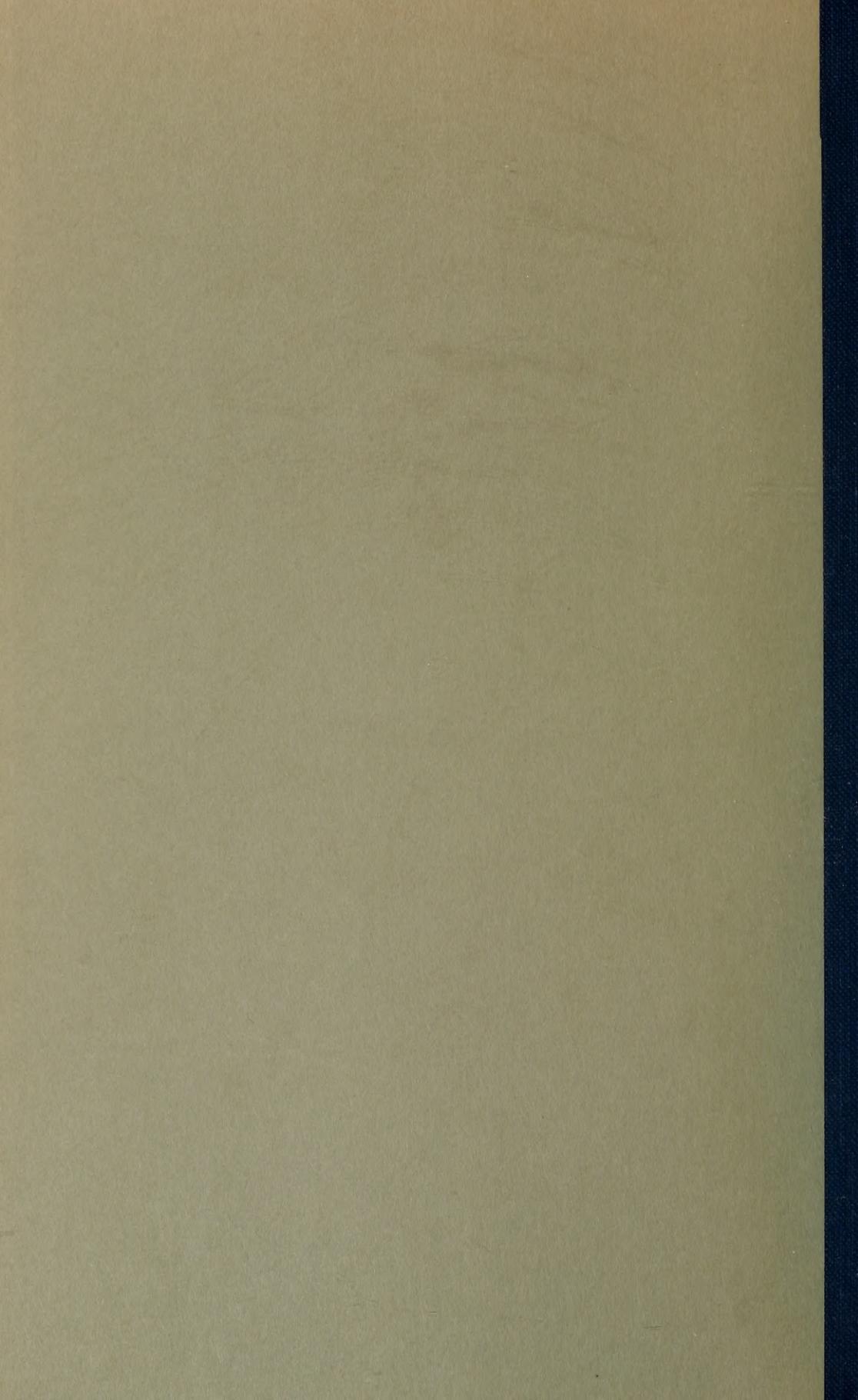


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1904

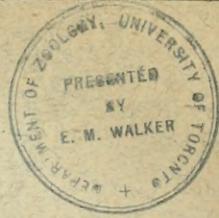


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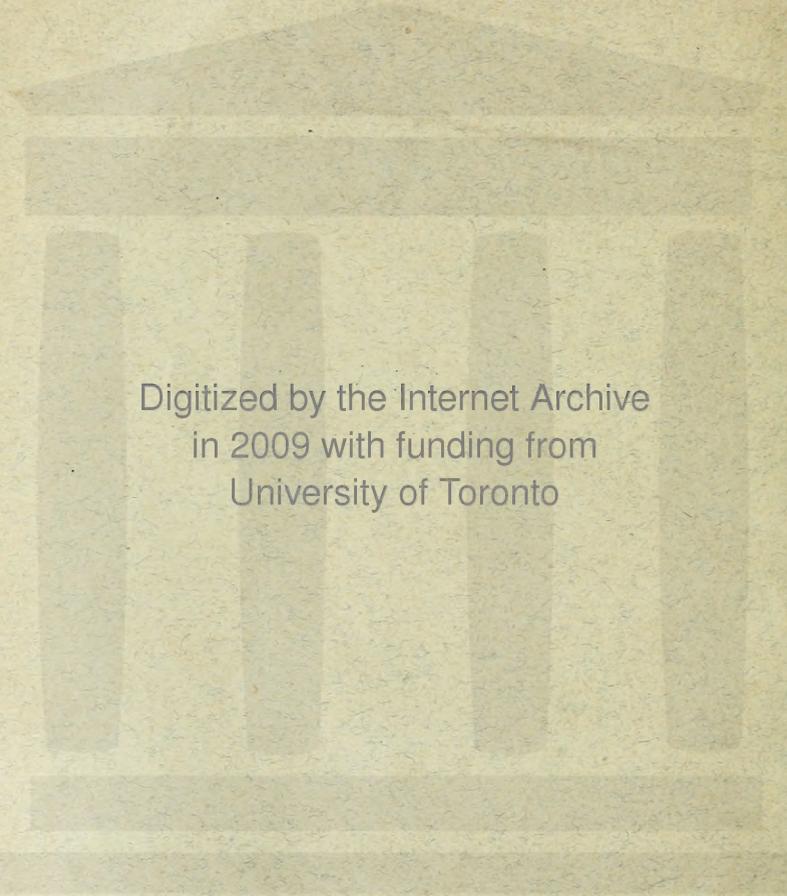
CENTRAL EXPERIMENTAL FARM

REPORT OF THE ENTOMOLOGIST AND BOTANIST

(JAMES FLETCHER, LL.D., F.R.S.C., F.L.S.)

1904

OTTAWA
GOVERNMENT PRINTING BUREAU
1905



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REPORT

OF THE

ENTOMOLOGIST AND BOTANIST

(JAMES FLETCHER, LL.D., F.L.S., F.R.S.C.)

1904.

OTTAWA, December 1, 1904.

DR. WILLIAM SAUNDERS,
Director of Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to hand you herewith a report of some of the most important subjects which have been brought officially under my notice during the past season.

The development of the Division of Entomology and Botany in the various directions has been pushed forward as evenly as possible, with an effort not to allow any work once undertaken to fall behind by giving undue attention to other branches.

Collections.—During the past year, as previously, the collections of insects and plants have been very much increased. Large additions have been made from material collected in the field, as well as also through the kindness of correspondents who have applied to the Division for help in their studies of insects and plants. The great attention which has lately been directed to Nature Study in schools has brought the officers into close contact with many teachers and students in the public schools of the country. There are few things more marked, in matters connected with the development of the country, than the keen interest which is being shown by all classes of society in those investigations which in a general way may be grouped under the head of natural history, and with which the work of the Division of Entomology and Botany is intimately associated. This includes not only a study of insects of all kinds, and plants, wild and cultivated, but also allied researches in forestry, the reclamation of land from the encroachments of the sea or of drifting sand, and also to a certain measure investigations into the habits of birds and animals with which farmers come into contact in their every-day life. This new movement in the schools of the country is giving to the growing boys and girls, who in a few years will be the citizens of Canada, an elementary knowledge of many of the common things which surround them every day of their lives, and which for this very reason are of importance to them. A practical knowledge of animals, plants and natural phenomena cannot but be of enormous assistance to the farmers of the country, whose every occupation is connected in some way with nature. The Nature Study movement is going steadily forward, and it has been a great pleasure to the officers of the Division to be in a position to encourage and help those who have taken it up so earnestly in all the provinces of the Dominion. Our collections here have been of much use in this work, and many visitors have availed themselves of the opportunity of consulting the cabinets.

Insects.—As in previous years, much time has been given to the rearing of insects, eggs or larvæ of many of which have been received by mail from all quarters or collected in the field. An exact knowledge of the preparatory stages of insects, the number of broods, and the time at which they develop, is of the greatest value when devising remedies for injurious species. Careful notes are taken of every species studied, and year by year the collections are enriched by the addition of specimens reared from the egg and prepared for the cabinets, showing all stages of growth, as well as the work of the various species. At the same time, records are kept for reference or for future use in the reports when sufficient data have accumulated or when occasion demands it.

Plants.—Extensive additions have been made to the herbarium, either from specimens sent in by correspondents for naming or as donations; and in many instances fine specimens of rare plants have been acquired by growing the plant from the seed and securing samples at different stages of development. During the year the herbarium has been gone over, and many imperfect specimens have been replaced by better ones, or additions have been made by increasing the series of various species by representatives from other localities.

The collection of weed seeds has been largely increased, and it is now a rare thing for a seed to be submitted by seedsmen or purchasers of seeds, or even to be sent in by students, which cannot be recognized. The institution of the Seed Division, under the Commissioner of Agriculture and Dairying, has had a most marked effect upon the quality of all kinds of seed now offered by seedsmen, and it may be justly said that at the present time, if purchasers will pay a reasonable price, they can easily obtain in Canada all crop seeds of the highest quality, both as to vitality and as to freedom from the seeds of other plants.

Fodder Plants.—The Experimental Grass Plots during the past season have been very attractive to visitors. The season at Ottawa was extremely favourable for the development of all fodder plants, and consequently very complete collections of all the leading hay and fodder plants were made for exhibition at the various fall fairs and other exhibitions where the government has assisted by sending exhibits. A large collection has also been made for the museum at the Central Experimental Farm.

Reclaiming Sand Hills.—A visit was paid to the large tract of shifting sand near Lachute, Que., locally known as the Argenteuil Sand Hill. This is estimated as now covering nearly one thousand acres, stretching along the Ottawa River in an elongated patch about four miles long by half a mile to one mile in width, for the most part entirely destitute of vegetation, but bearing in places clumps of spruce trees, birches, maples, tamaracks and willows. As is usually the case on such areas, the surface is very dry; but a few inches below this there is an abundance of moisture available for the support of any plants which can be protected against the drifting sand. At the request of Mr. Thomas Christie, M.P., I called upon the various farmers living around this sand hill and examined the work they had been doing in their efforts to control the sand. I found, without exception, that every one of them had taken a keen interest in fighting against the common enemy, and much good work had been done in the way of holding back the drift by planting trees and other vegetation. Since 1898 the attention of the Division has been directed to this tract of land, and a few hundreds of plants of the Beach Grass, and also of Norway and White Spruce trees, have been sent to different farmers to be planted on the sand as an experiment; but no extensive work has been carried on by the department. I was much pleased to see the success which had attended the efforts to grow trees on this apparently barren sand hill. The kinds of trees which were noticed growing wild in the scattered clumps which here and there appear, were White Pine, Tamarack, Canada Balsam, White Spruce, White Cedar, Balm of Gilead, Aspen Poplar and White Birch; and round the edges all the ordinary forest trees of the region are represented. In low spots two or three kinds of willows and the Gray Alder flourish. Of shrubs which attracted attention by their vigour and

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the extent to which they had spread out in every direction, special mention may be made of the following kinds which doubtless can be made use of in prosecuting this work. The Willow-leaved Meadowsweet (*Spiraea salicifolia*, L.).—This free-growing bush, which not only produces large numbers of running roots or stolons, but also ripens much seed, was found to be covering many acres and spreading rapidly over some low spots in the central portion of the sand hill. This is a native shrub, common in all swamps and low lands. The Red Raspberry (*Rubus strigosus*, Mx.).—A form of this common shrub was seen covering a large area on the farm of Mr. Thomas McGregor, who has encouraged its growth, as well as some other native plants which occur with it. The common Blackberry (*Rubus villosus*, Ait.).—Even more luxuriant than the Red Raspberry was the Common High Blackberry, which rooted freely through the sand and threw up many stems. Both of these berry-bearing plants produce heavy crops of excellent fruit, and it seems as though they might prove a valuable resource to farmers, while at the same time performing the important office of providing a barrier against the encroachments of the sand or as a temporary shelter, while more valuable trees are being grown. Roses.—At various places old and vigorous clumps of Sweetbrier, which were evidently many years old, were seen, as well as of the little old-fashioned semi-double Cinnamon Rose. The Smooth Meadow Rose (*Rosa blanda*, Ait.) was found in spots, covering several yards in diameter and showing an unexpected power to grow up and keep its head above the drifting sand. Shrubs which also showed great vigour and which occurred in many parts of the sand hill, where evidently they had sprung up spontaneously, were the Red Osier Dogwood (*Cornus stolonifera*, Mx.) and the Beaked Hazel (*Corylus rostrata*, Ait.). Of the wild herbaceous perennials growing naturally on the sand, and the growth of which had to some extent been encouraged, the most noticeable were the Common Milkweed (*Asclepias cornuti*, Deene.), the Canada Thistle (*Cnicus arvensis*, Scop.), and Couch or Quack grass (*Agropyrum repens*, L.). There were also seen in some places a few plants of the Strawy Sedge (*Carex straminea*, Selk.), the Ox-eye Daisy and the Dandelion.

The trees which have been experimented with to the largest extent by farmers living in the locality are the White Pine, Canada Balsam Fir, the Norway Spruce, the White Spruce and the Tamarack or American Larch. Of these, the last-named has made the most rapid growth, but seems to require more protection than the sturdy spruces. The Balsam Fir has succeeded as well as the spruces, but is a less valuable tree. The Norway Spruce has been planted only to a small extent, a few hundred trees having been sent from this department three years ago. These were planted carefully, and doubtless will succeed; but it is too early as yet to compare them for this purpose with the White Spruce, which is the favourite conifer and is transplanted from the woods in the neighbourhood. The greatest satisfaction is expressed by all of the way in which willows have succeeded. The kind used for the most part is the large European Tree-Willow (*Salix alba*, L.) known mostly in this country under the name of French Willow. Large numbers of these trees have been started from cuttings and have in a single year made a remarkable growth, even from small cuttings put in with little labour in a furrow made by a plough. Such plantations were seen on the farms of Mr. John Doig and Mr. Walter Smith. On the edge of one of Mr. Doig's plantations the sand had been drifted away by the wind so as to expose the roots of one of his trees. These, by actual measurement, extended for forty feet from the central point, showing the great value of the willow as a sand binder, both from its rapid growth and from its great root production. An observation of much interest, as showing the power of the Canada Balsam to resist destruction by sand, was that this tree, when covered up to a certain extent with sand, threw out large numbers of roots from the branches which were partially submerged. (See Plate II., fig. 10.) Many samples of such branches were found upon trees which had their roots and trunks covered up with from six to ten feet of sand. Experiments with Beach Grass and the Sea Lyme Grass have been very satisfactory, particularly where the former has been planted on

exposed banks. In low, undisturbed spots the Sea Lyme Grass has succeeded rather better than the Beach Grass. Tufts of both of these grasses were found in some places to have extended four feet in each direction by the end of the second year, and on Mr. Walter Smith's land one clump was found which had a thick growth four feet across in the centre, with five smaller shoots round it and 18 shoots just showing through the sand, which will produce tufts of leaves next spring at a radius of twelve feet from the centre.

It is hoped next year to encourage this work by sending a large consignment of Beach Grass and several thousand cuttings of those willows and poplars which have shown the greatest vigour at Ottawa and at our western experimental farms. The enthusiasm and interest shown in this subject by the farmers themselves, every one of whom has already gone to much trouble and expense, is most encouraging. I can see no reason why in a few years this large tract of sand may not be brought under control.

Meetings.—Meetings of farmers, dairymen, fruit growers, &c., have been attended whenever other official duties would allow of my absence from Ottawa.

December 28, 1903: St. Louis, Mo.—Annual meetings of the Society for the Promotion of Agricultural Science, of the Association of Economic Entomologists and of the American Association for the Advancement of Science.

January 29, 1904: Cowansville, Que.—Convention of District of Bedford Dairymen's Association.

February 12: Ormstown, Que.—Huntingdon Dairymen's Association.

April 18: Perth, Ont.—Horticultural Society and address to school children of the Public Schools in the town hall.

May 5: St. Catharines, Ont.—Meeting of fruit growers to discuss the San Jose Scale remedies.

May 6: Toronto.—Normal School: Address on Nature Study.—Toronto Branch of the Entomological Society of Ontario and Toronto Horticultural Society—joint meeting: Address on 'The Opening of Spring and Spring Work.'

June 14: Amherst, N.S.; and June 18: Halifax, N.S.—Meetings of Maritime Stock Breeders' Association and Nova Scotia Farmers' Association.

June 21 to 24: St. John, N.B.; June 16: Kentville, N.S.—Address before King's County Board of Trade on 'Orchard Insects.'

June 27 and 28: Gaagetown, N.B.—Address before Farmers' and Dairymen's Association on 'Farm Insects,' and attending spraying demonstration in orchard.

July 11 to August 11.—In Manitoba and the North-west Territories, holding weed meetings for the North-west government.

September 5: Brome, Que.—Attending the Brome County Fair and judging horticultural exhibits.

September 9 to 17: Halifax, N.S.—Attending the Nova Scotia Provincial Exhibition in company with the Dominion Live Stock Commissioner. Meeting farmers and fruit growers in the Farmers' Pavilion and delivering addresses on Noxious Weeds and Injurious Insects.

September 19 to 23: St. John, N.B.—Attending Canada's International Exhibition and judging the natural history exhibits sent in by the school children of the province. This competition is worthy of special mention on account of the excellence and number of collections sent in. No less than 83 separate collections, aggregating nearly three thousand specimens, were on exhibition and formed a most attractive exhibit. For the most part, the specimens were well preserved, neatly mounted and labelled. The identifications in most of the collections were also as accurate as could be expected under the circumstances. On the whole, I believe that this competition was the most extensive and best managed of any similar effort which has ever taken place in Canada. The example of the Exhibition Association may well be followed by other similar institutions.

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September 24 to 30 : Charlottetown, P.E.I.—Provincial Exhibition. Attending meetings and giving addresses in the Farmers' Pavilion upon Weeds, Hay and Pasture Grasses and Injurious Insects.

October 19 : Lachute, Que.—Visiting the Argenteuil Sand Hill and discussing with farmers means of controlling the drifting sand.

October 21 : Whitley, Ont.—Visiting the Model Fair Grounds with the Live Stock Commissioner and examining the illustration plots of various crops; and also the fodder crops grown in the district.

October 26 and 27 : London, Ont.—Annual meeting of the Entomological Society of Ontario : 'Injurious Insects of the Year,' 'Entomological Record for 1904.'

November 15 : Toronto, Ont.—Provincial Fruit, Flower and Honey Show : Address on 'The Value of Bees to the Fruit-grower.'

In addition to the above, Mr. Arthur Gibson attended the County of Carleton Annual Exhibition at Richmond, Ont., and judged the natural history exhibits made by the teachers and school children of the county. These exhibits were on the whole very satisfactory, and showed good careful work on the part of the teachers.

Mr. Gibson also attended the annual meeting of the Entomological Society of Ontario at London, and took an active and acceptable part in the proceedings, reading two papers : 'Further Notes on Basswood or Linden Insects,' and 'The Columbine Borer (*Papaipema purpurifascia*, G. & R.).'

Acknowledgments.—I have again gratefully to acknowledge many favours from specialists who have assisted me with identifications of many specimens of insects received for the collections during the past year. My thanks are specially due to Dr. L. O. Howard, Chief of the Bureau of Entomology at Washington, and members of his staff, particularly Dr. H. G. Dyar, Dr. W. H. Ashmead, Messrs. Schwarz, Coquillett and Busck; also to Prof. J. B. Smith, of New Jersey; Mr. W. D. Kearfott, of Montclair, N.J.; Prof. J. S. Hine, of Columbus, Ohio, and Rev. G. W. Taylor, Wellington, B.C.

Valuable additions to the collections of insects have been made by the following :

Mr. F. H. Wolley-Dod, Millarville, Alta.—A collection of named noctuide from Alberta.

Mr. T. N. Willing, Regina, N.W.T.—Many specimens of insects of all orders from the North-west Territories.

Mr. Norman Criddle, Aweme, Man.—Many rare moths and other insects from Manitoba.

Mr. W. Metcalfe, Ottawa.—A large collection of minute diptera and other insects beautifully pinned, mounted and labelled.

Mr. A. W. Hanham, Victoria, B.C.—A large collection of pinned hymenoptera, diptera and hemiptera taken in Manitoba and British Columbia.

Mr. E. F. Heath, Cartwright, Man.—A collection of Manitoban moths in papers.

Mr. C. H. Young, Ottawa.—Specimens of rare moths taken at Ottawa.

Mr. E. P. Venables, Vernon, B.C.—A collection of named *Bombi* taken at Vernon, B.C.

Correspondence.—The correspondence of this Division has been sufficient during the past year to take up every minute of the time of the officers which could be spared from time necessary for investigation. Many thousands of specimens of insects and plants have been received from students for naming. This requires much time, but is of great value in the work of the Division in bringing the officers into contact with students all over the country and in learning of the occurrence of many insects and plants, which otherwise would not come to their notice. From December 1, 1903, until November 30, 1904, the number of letters, exclusive of circulars, registered in the Division as received on official business was 3,231, and the number despatched was 2,909.

I have the honour to be, Sir,

Your obedient servant,

JAMES FLETCHER,
Entomologist and Botanist.

DIVISION OF ENTOMOLOGY.

CEREALS.

The season of 1904 in all parts of the Dominion has been remarkably irregular and uncertain. Extensive areas have suffered from drought, while in other places there has been trouble from too much rain at certain periods; crops, accordingly, have been very irregular. Through the greater part of the Maritime Provinces and in the eastern part of the province of Quebec, a prolonged drought during the months of June, July and August reduced enormously all hay and grain crops. In the western portion of the province of Quebec and in eastern Ontario, weather conditions were very favourable and excellent crops of grain and hay were secured. In western Ontario, on the other hand, and in the whole of the province of British Columbia, hot dry weather prevailed and somewhat reduced crops of all kinds. The Ontario November crop report describes the wheat crop as below the average and rather light in weight; barley as one of the most successful crops of the year; oats a splendid crop, yield and quality most gratifying. Throughout the Dominion, however, the season on the whole has been cool and backward. In the North-west Territories and Manitoba the growing season began late; but with improved summer conditions and no killing frosts until rather later than usual, a large crop was reaped. The quality was not quite as high as was at one time hoped for, owing to rain at harvest time and slight frosts in some localities, and also to a certain amount of injury by rust. Rust is almost unknown in the West as a serious enemy of cereal crops; but during the past season a more severe epidemic of this destructive parasite made itself manifest towards the end of August, than has ever previously been recorded. Mr. J. R. C. Honeyman, the Deputy Commissioner of Agriculture for the North-west Territories, although stating that the presence of rust last summer was a factor to be considered, claims that practically it did not affect the crops in the Territories to any appreciable degree. Writing on November 16, he says: 'There is a large amount of very good grain in the country, and prices are satisfactory. However, a comparatively small proportion of the crop has been marketed, owing to the continued fine weather, which enables farmers even at the date of writing to continue their fall ploughing.'

Mr. J. R. Anderson, Deputy Minister of Agriculture for British Columbia, writes: 'The abnormally dry season which extended through the whole of the province, had the effect of reducing considerably the production of all crops in those parts where irrigation is not practised, because it is unnecessary. Spring wheat was generally a failure where it is grown for milling purposes. Fall wheat was better, but on the whole, milling wheat was short. Nevertheless, some fine samples were produced. Kansas Red from Spallumcheen weighed 69½ lbs. per bushel, with a fine, hard, plump grain. Oats and other small grains were good where the seed was got in early, and on irrigated land. In dry regions these crops were indifferent.'

In Northern Alberta the summer was fine and dry, and grain crops were better than they had been for two or three years, except in some instances where poor seed oats had been sown. No mention was made of rust. In Manitoba, however, the injury by the Black Stem Rust caused great anxiety to farmers. Some crops were actually cut green or before they were ripe to save further damage. The districts most affected were between Brandon and Winnipeg and in the south and west of the province. Loss from this cause was not confined to the West. Reports from Ontario and Quebec mention rust on wheat, oats and barley, and a consequent shrinkage in those

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crops. An undetermined injury referred to as 'Dead Heads' by settlers also occurred rather widely in Manitoba just before wheat harvest. Unfortunately, no cause for this injury which involved patches of from two to fifteen feet in diameter, could be discovered by my correspondents, who made investigations in accordance with suggestions sent to them. Neither fungus nor insect enemy could be discovered. Mr. Geo. H. Greig, Secretary of Live Stock Associations of Manitoba, wrote that the injury ceased about August 20, and that in speaking with the farmers in the district where this occurred, the opinion seemed to prevail that new land was worse affected than old, and he estimated the loss in the fields which showed most of the injury at about 5 per cent.

Among insects which have attracted attention by their numbers on cereal crops during the season of 1904, mention may be made of the following:—

WIREWORMS.—Wireworms in grain fields were complained of in New Brunswick, near St. John, on Prince Edward Island, at Kensington, and at Qu'Appelle in the North-west Territories. These troublesome larvæ, for which up to the present time no satisfactory remedy has been discovered, did much harm by eating into the young sprouting grains of wheat. It was noticed by Mr. William Henley, of Qu'Appelle, that oats sown on the same land where wheat was being destroyed, were not injured by the wireworms. The destruction of the wheat, however, was considerable. He writes under date June 20:—'Wireworms are destroying our wheat crop in the Wascana District (T. 13, R. 15, W. of H., 30 miles south of Qu'Appelle). This is heavy hummocky land full of humus. I broke a hundred acres last summer, disked it in the fall and harrowed it before and after seeding this spring. I shall not get over half a crop from it. I am breaking another hundred acres this summer, and should like to avoid this trouble next season, if possible. Would more cultivation in the spring have any effect on this insect, or would you recommend putting on extra seed? I don't think this worm does much harm after the wheat has germinated. We had two weeks of cold weather this spring after seeding, and the seed did not start to grow for some time. This was when the wireworms did most harm.'

A remedy which has given a measure of satisfaction to those who have tried it, is to plough the land twice in autumn—once in August, when the wireworms (the larvæ of several species of Click Beetles) change to the pupal condition, in which they are soft and easily injured, and then again in October or later, when the perfect beetles have formed but are still too soft and delicate to stand the cold of autumn and winter if their pupal cell is broken. This late ploughing also exposes them to many enemies. In the North-west, as Mr. Henley has pointed out, it is very rarely possible to plough land as late as October. The present open season, nearly up to the end of November, gives farmers a good opportunity to try this remedy. It has been noticed that oats are not so much attacked as wheat; and barley and rye are even less so, therefore, when land is found to be badly infested with wireworms, it will be advisable to sow other crops than wheat.

CUTWORMS IN GRAIN.—In the middle of July the 'Nor'-West Farmer' referred to the Division several complaints of injury to wheat crops by cutworms (Plate I, fig. 1), and specimens were received from Manitonas, Man. These proved to be the Red-backed Cutworm (*Paragrotis ochrogaster*, Gn.), which is a very general feeder, but, as a rule, restricts itself in a large measure to the weeds growing in grain crops, instead of attacking the grain. Occasionally, however, as in the oat crops of Manitoba in 1901, widespread injury was done by this cutworm; and, in 1900, as well as in 1901, several undoubted instances were reported of its attacking wheat. This bad habit, however, must be considered exceptional; and it is particularly to low vegetables and root crops that the Red-backed Cutworm does harm. The Glassy Cutworm (*Hadena devastatrix*, Brace), a greenish white caterpillar with a red head, which works beneath the ground, damaged wheat fields seriously in the neighbourhood of Virden, Man.

In grain fields it is difficult, as a rule, to apply remedies for cutworms; but, as many of the different kinds assume a marching habit as they clear away the food be-

fore them, it is frequently possible to prevent damage to a large extent by applying poisoned bait in advance of their line of march. The poisoned bran remedy, which gives such remarkably good results against all surface feeding cutworms, is probably the best form of bait. This can be scattered lightly through the grain near the spots where the caterpillars are numerous, and the small particles of bran will be found by the cutworms, which eat this material with avidity. For the Glassy Cutworm, which feeds almost entirely underground, this remedy would be of little avail, and the best means of combating this insect is to keep the land to be used for small grain crops the following year as free as possible from long grass and weeds in the autumn before. Prairie or sod land which is to be broken for seeding the next year should be fed off as late as possible or mowed before breaking. In this way the female moths will not be attracted to the tall vegetation on such land when laying their eggs.

GRASSHOPPERS.—I visited the districts in Central Manitoba lying between Treesbank and Douglas in the middle of July, and saw no traces of injury by locusts. Mr. N. Criddle, of Aweme, writes under date of November 1: 'As was anticipated, locusts did not hatch out in sufficient numbers to cause any loss to farmers in this district. A few reports of their being unduly numerous were heard in the spring from places south-east of here; but, as far as I can learn, very little, if any, damage was done. The gradual disappearance of these troublesome pests seems to have been brought about chiefly by the multiplication of their well known parasites, mention of which was made in my last year's report.'

The kinds of grasshoppers which have been devastating the crops in Central Manitoba for the last four years are the Rocky Mountain Locust (*Melanoplus spretus*, Uhler), the Lesser Migratory Locust (*M. atlantis*, Riley), and Packard's Locust (*M. packardii*, Scud.). The two parasites referred to by Mr. Criddle are two blister beetles, *Epicauta sericans*, Lec., and *Epicauta pennsylvanica*, DeG., as well as two or three kinds of *Tachina* flies.

In some of the dry regions of British Columbia another species of locust, *Camnula pellucida*, Scud., appeared in a few places, and did a good deal of harm on the ranges. Mr. George Packham, of the Plateau ranch, Okanagan Mission, writes on June 25: 'Grasshoppers are coming out in thousands again this year. Last year they destroyed most of the crops and damaged the young orchards considerably. Is there nothing that can be done to check them? Is there not a fungous disease that the Australian government supplies to settlers? If so, could not our government supply it to us at cost price? It is important that we get it immediately, or we shall lose acres of vegetables and thousands of young trees.' In view of the great success which had been obtained by Mr. Criddle in controlling vast hordes of grasshoppers in Manitoba in a practical way with the Criddle mixture, I recommended Mr. Packham to try that mixture in the Okanagan country. It has been noticed that the Pellucid Locust, which was the species there prevalent, has the habit of occurring in dense swarms in rather restricted localities, and therefore gives a good opportunity for the application of poison.

The Criddle mixture, for convenience, is made in quantities of half a barrel at a time. It consists of fresh horse droppings 100 parts, Paris green 1 part (=1 pound), and salt 2 pounds, dissolved in half a pail of water, and the whole mixed together. In this connection, Mr. Criddle says: 'We usually measure with a three-gallon patent pail, because it is more convenient to farmers than to weigh the material. Five pails we calculate approximately equal 100 parts of horse droppings, and each part equals in bulk one pound of Paris green. The great drawback in using weights is that horse droppings are not always of the same weight.'

The propagation and wholesale cultivation of the fungous disease for the destruction of grasshoppers of all kinds, which is mentioned by Mr. Packham and has been inquired about from time to time by many other correspondents, I regret to say, has not proved to be, on the whole, of much service in fighting outbreaks of injurious locusts.

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For a short period, and in restricted localities, with all conditions favourable, good results have occasionally been obtained; but the difficulty of preserving the spores alive and using them when required, has been so great that all entomologists who have experimented with the fungus have, after a short time, relinquished the effort in favour of other methods not so dependent for their most effective use on climatic conditions. Hopper dozers and other mechanical contrivances have proved of much service; but the best results have followed agricultural methods of control, such as the early ploughing down of all stubble lands, in which by preference the eggs are laid, before the young emerge in spring or have grown to such a size as to be able to save themselves by hopping or flying, so as to avoid being ploughed down and buried.

The HESSIAN FLY (*Cecidomyia destructor*, Say).—Injury by this destructive enemy of the wheat crop has been slight this year. Most reports merely refer to its absence. Last year specimens were found as far west as Indian Head, N.W.T. In Manitoba it has done less harm by far than in 1903. Mr. Norman Criddle, who has been on the lookout for it, says: 'The only report of this insect comes from Mr. Cooper, of Treesbank, who states that quite a number of puparia were to be found on his stubble fields this autumn and that he estimated the damage on his farm at about half a bushel to the acre. Elsewhere in the province, it is just possible that this insect may have escaped notice on account of the damage done by rust. There was no appearance of Hessian Fly here at Aweme.'

Prof. F. M. Webster, who is making a special study of wheat insects in the United States, writes at the end of this season: 'I found Hessian Fly in large quantities in North Dakota, quite as bad as in many places further south. You will be interested in hearing that from a lot of stubble collected west of Fargo, I have not reared a single adult this autumn; but from stubble collected at Lincoln, Nebraska, we get plenty of adults, showing that there must be a dropping out of the fall brood somewhere between these two localities.'

This observation confirms the opinion that there is only one brood of the Hessian Fly each year in our western wheat fields. This is an important fact, as indicating a proper remedy, and shows the value of cutting wheat high and then burning over the stubble before the time when the flies emerge in spring. In the Ontario November Crop Returns we find: 'The crop suffered much less than in recent years from Hessian Fly and other insects;' and 'in the new fall wheat little injury was complained of, compared with the ravages of this pest during the past three or four years.' In Prince Edward Island, where the Hessian Fly is always present to some extent, little harm was done, but specimens of infested straws were received from Mr. A. M. McMillan, of Eldon, P.E.I.

WHEAT-STEM SAWFLY [*Cephus pygmaeus*, L. (?)].—The intermittent manner in which this insect attacks wheat in the North-west was again demonstrated this year. It was not reported from any of the localities where it did harm during the past two years. The only place where a crop was injured conspicuously was at North Portal, Assa. Mr. George Harris writes under date August 24: 'I send samples of wheat injured by a small white worm. The attack is worst on the edges of fields, but is present all through the grain. Where the plants stand thick, you can cut with a binder; but where thin, the wheat falls down and there are patches three and four feet square, which are quite flat.'

The worm which causes this breaking of the straw is the larva of a slender black four-winged sawfly, about one-third of an inch in length, banded and spotted with yellow. The eggs are inserted into the straw by the females near the top of the stem; and the grub on hatching eats its way down to the root, near which it passes the winter in a cocoon spun inside the stem, but above which it has first gnawed almost through the walls of the straw, so that about harvest time injured stems fall over easily and break off, leaving the grub inside the stubble, where it remains, and about June of the following year turns first to a pupa and then to the perfect fly. Burning over

stubble fields and ploughing down all land left for summer-fallow early, so that the cocoons may be destroyed by the burning or buried so deeply that the flies cannot emerge, are the remedies recommended.

The GRAIN APHIS (*Neclarophora granaria*, Kirby).—It is probable that two or three species of plant-lice have been spoken of collectively by correspondents under the name of the Grain Aphis, as there is a remarkable difference in the appearance and colour of many of the plant-lice described in their letters, and very few send in specimens of what they consider a so well known insect. The grain plant-lice were more complained of this year in the West than any other enemies of cereal crops. They were exceedingly abundant in many places, and did some harm by sapping the stem and grain and causing shrunken wheat. Specimens were sent from New Brunswick by Mr. W. H. Moore, of Scotch Lake, and reports of unusual abundance were received from several places in Ontario. Nevertheless, there was little appreciable injury to grain crops in the East. In Manitoba and the North-west grain plant-lice were in places so abundant as to cause a good deal of anxiety. Mr. T. N. Willing, the Chief Territorial Weed Inspector, of Regina, reports that the Grain Aphis was very plentiful at some points, particularly north of Wapella, N.W.T. 'They were so abundant on Mr. F. Carr Dufton's farm, Wapella, and that of Mr. W. M. Gordon, Hazelcliffe, that the binder was actually stopped by reason of the canvas slipping on the rollers, from the slipperiness caused by the crushed plant-lice, and these were cleared off from the platform by the shovelful.'—T. N. WILLING.

'Pilot Mound, Man., Aug. 17.—I send wheat heads attacked by the Grain Aphis. I have a large acreage in which the grain is infested; but the only harm I can see that they do so far is to delay ripening. In walking only a short distance into the standing grain my clothing became covered with these insects.'

'Aug. 28.—The plant-lice which were so abundant when I last wrote, soon afterwards suddenly disappeared. They got wings about August 18 and flew away, I hope, never to return.'—PHIL. W. ROBINSON.

'Winnipeg, Man., Sept. 6.—We send sample of wheat received from a farmer at Wawanesa, Man. You will notice that it is affected by a small insect which is working on the head. The farmer writes: "The heads of the wheat are covered with a small insect of a green and black colour, which seems to be a bad pest. The heads of the wheat are covered with them and there must be millions in a single field. They seem to be sucking out the juice of the straw and the berry."—W. J. BLACK, Editor *Farmers' Advocate*.

'Yorkton District, Assa. (30.25.2.W. of 2nd), Sept. 13.—There was an insect on the grain this year which, had it come sooner, would have done a great deal of damage. There are millions of them on the oats, and I understand they are on the wheat also. They cluster around the kernel.'—A. C. GIBSON.

So far, no treatment has been discovered for controlling plant-lice on grain crops; but fortunately, they very seldom affect the output to any considerable extent; for an excessive occurrence of these insects is invariably attended by a correspondingly abundant development of parasites which feed upon them.

The WHEAT MIDGE (*Diplosis tritici*, Kirby).—It is many years since any noticeable loss from the larvæ of the Wheat Midge, usually called 'The Weevil' by farmers and millers, has taken place. Fifteen years ago the injury through the country was enormous, but suddenly, about 1889, the insect practically disappeared from our wheat fields. In 1898 a rather severe outbreak—the loss amounting to about 25 per cent of the crop—appeared as suddenly in the Niagara Peninsula, particularly along the lake shore in the county of Lincoln. Nothing has been heard of the Wheat Midge since that time, there or elsewhere, until the past summer, when specimens were sent from the fertile Chilliwack district of the Fraser River valley, in British Columbia. Mr. J. R. Anderson, in his report on the crops of the year, says: 'The Wheat Midge

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(*Diplosis tritici*, Kirby) made its appearance at Chilliwack, but does not seem to have shown itself elsewhere. Where noticed, the infested wheat was destroyed by fire.'

Specimens of wheat heads more heavily infested than any I have ever seen, were received from Mr. Henry Kipp, of Chilliwack.

Chilliwack, July 27.—I enclose heads of wheat infested by a small red maggot. There were a few last year, but this year my field is ruined. Please let me know what it is, and send a remedy if there is any. I believe there are hundreds of acres more or less injured by this insect. You will be doing the farmers of this district a great favour if you publish a remedy for it so that we may be ready to protect ourselves another year.'—R. ROBERTS.

Chilliwack, July 28.—I enclose heads of wheat infested with a little red insect, which is attacking all the wheat crops here. Is there any remedy? I suppose not, as the wheat is so far advanced and is just beginning to ripen. I hear rumours of barley being attacked. So far, oats and peas are not. I see under the microscope this little insect resembles a minute worm. Most people, including myself, are going to cut the wheat green.'—G. MAXWELL STUART.

Chilliwack, Nov. 24.—As far as I can hear, wheat was damaged by the Wheat Midge more or less all over the lower Fraser valley; the extent of the injury varied according to locality and to the state the wheat was in when the Midge attacked it. On the whole, the average would be, I think, less than one-third of the crop for the turn out. I heard of one farmer who only got 10 sacks of wheat off 10 acres; another got 25 bushels off five acres; he estimated the crop, before the Midge attacked it, at at least 20 bushels to the acre. On the other hand, Mr. Evans, of Sumas, had his wheat in very early; and it was not injured at all. I suppose the wheat had got too hard for the Midge; and for the same reason the fall wheat here was not hurt at all. I do not put in much wheat, my land being better suited for clover and peas; but off two acres which looked very well before the Midge came, I got only about two sacks. A good many cut their wheat for hay as soon as they knew it was attacked. Do you think this insect is likely to occur again next year? It would be a useful hint to farmers if you could include in your report a suggestion as to whether it would be wise to sow much wheat or not.'—G. MAXWELL STUART.

As to sowing spring wheat next year in the Chilliwack valley, it would certainly be wiser not to do so, but to use the land for some other crop such as oats or barley, which are not attacked by the Wheat Midge. It is, of course, possible that the Midge may not be abundant next year; but it is much more likely to be present in some numbers, which would make it unwise to grow wheat when the land can be used for so many other valuable crops.

Chilliwack, November 28.—*Re* losses from Wheat Midge in this valley, I may say they were even more serious than I first thought. After attending a number of threshings, I am sure fully half of the wheat crop was destroyed by it; there would be found several bushels of the grub underneath the machine after it had worked one or two hours. But a few like myself cut their wheat and made hay when the insect was found to be bad; but I may say the loss was not felt as bad here as it would have been in a wheat-growing district; for the farmers here only grow wheat for feed, and only a comparatively small acreage is annually sown to wheat; so the loss, although considerable, will not be felt very much, and the chickens will have to eat something else. I notice an increase in the acreage of fall wheat sown this fall; for, strange to say, the insect does no harm to fall wheat, and a few fields of very early spring wheat escaped the Midge. I have just rubbed out a few heads of the wheat which I cut for hay, and find the grub still there, with no change, as far as I can see, since I first noticed it.'—R. ROBERTS.

All the samples of infested wheat received were remarkable for the enormous numbers of the larvæ clustered round the grains in each floret; and, although few farmers reported injury by the Midge, this was without doubt great where the insect

occurred. Immediately on receipt of the samples an article was prepared for the *Province* newspaper of Vancouver, B.C., in which the insect was described and the best steps to take were mentioned, so that as much as possible loss might be minimized in the future. The Wheat Midge possibly attacks some grasses, but has never been detected, as suggested above, on barley nor upon oats and peas.

The Wheat Midge and its attack are thus described in my report for 1888, page 49, which I reprint here, as I have nothing further to add to it in the way of useful information:—

‘The Wheat Midge is more widely known in Canada under the inaccurate designation of ‘Weevil,’ a term which must be discouraged, because it belongs to another class of insects altogether. The weevils are hard-shelled beetles, with elongated snouts, while the Wheat Midge in its larval stage is a legless maggot, and, when in the perfect state, a delicate gnat-like creature with gauzy wings. The life history of the Wheat Midge, as at present understood, is as follows:—During the month of June, just when wheat is in blossom, tiny yellow midges with black eyes and yellow bodies may be seen flying over the fields, particularly on dull days or towards evening. Large numbers of the same midges may also be seen in houses as soon as the lamps are lighted. These are the Wheat Midge and the parents of the Red Maggot of wheat.

‘The body of the female fly is prolonged into a long slender tube which can be extended or drawn in at pleasure. With this tube, which is called the ovipositor, she pushes her minute eggs down between the chaff of the green wheat ear. In about a week these eggs hatch into small transparent yellowish maggots, which at once attack the forming grain. Gnawing through the outer skin of the kernel of wheat, they extract its juices and prevent it from filling out properly. As these larvæ grow older, they gradually become darker in colour until they acquire the tint which has given them the name they are best known by in England, “the Red Maggot of the wheat.” Grain injured by the Midge has a characteristic shrivelled appearance, known amongst millers as “fly struck.” There are sometimes four or five maggots to each grain in an ear.* As soon as the maggots are full grown they either work their way up between the scales of chaff and fall to the ground, or remain in the ears until the crop is carried. Those which fall to the ground—and these are by far the most numerous—penetrate about an inch beneath the surface, where they spin a small cocoon of exceedingly thinness, which fits so closely to their bodies that it is sometimes thought to be only the skin hardened, in the same manner as takes place in the case of many other flies when they pass through their pupal or quiet state. It was generally supposed that the perfect flies from these pupæ did not appear until June in the following year. This, however, is not always the case, for, on a warm, damp evening in August, and again in the beginning of September, 1888, large numbers flew into my study and were killed at the lamp. Prof. F. M. Webster, a special agent of the United States Department of Agriculture, on one occasion bred considerable numbers of perfect Midges in the month of July, from heads of wheat which had been badly attacked by the red maggots during the previous month; and, off and on, during the rest of the summer until November, he caught the perfect insects at large. In the report of the United States Entomologist for 1884 the same observer records as follows:—“From September 4 to 15, I not only found larvæ in considerable abundance under the sheaths of volunteer wheat, but adults too in the same situation, and also on the outside of the plant or hovering above the upper leaves. From a quantity of this wheat placed in a breeding cage, on September 7, appeared three or four adults.” Not only, then, did these maggots of June produce perfect flies that same summer, but there was a second brood which had time to lay eggs in the young fall wheat. That this insect has a double life history, living both in the ears and later in the season in the shoots of young

*There were from 10 to 15 in almost every instance with each grain in the heads sent from British Columbia this year.

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wheat plants, is an important discovery made by Prof. Webster, and suggests another means of checking its ravages.'

Remedies.—The remedies for the Wheat Midge, as for all other insects which attack crops, depend largely upon its habits and the way in which it passes the winter. Those methods which have given the best results are as follows:—

1. Deep ploughing directly the crop is carried, so as to bury the larvæ so deep that the flies cannot work their way out through the soil.

2. The burning of all chaff, dust and rubbish known as 'screenings' or 'tailings' from beneath the threshing machines, as these contain many of the larvæ which are carried with the crop. If fed to chickens or domestic animals, this should be done in a place where none of the puparia can escape destruction.

3. Clean farming, including the cutting of all grasses along the edges of fields and the ploughing down of all volunteer crops found in wheat fields before winter sets in, so as to destroy an autumn brood where one exists.

4. The cultivation of such varieties of wheat as experience has shown are least affected by this insect. There is a great difference in kinds of wheat in this respect, and from time to time so-called 'midge-proof' varieties have been introduced, but it is probable that there is no truly midge-proof variety of wheat as yet known.

The PEA WEEVIL (*Bruchus pisorum*, Linn.).—The satisfactory state of affairs referred to in my last year's report as to the sudden and remarkable decrease in the numbers of this pest has continued, and, even to a greater degree, during the summer of 1904. This sudden cessation of activity on the part of such a persistent enemy cannot be accounted for by any one cause; but it must be claimed to be due, to some extent at any rate, to the persistent work which has been done by entomologists in stirring up farmers to greater care in treating their seed pease before sowing them, and in harvesting and treating the crop as soon as possible after it is ripe. Many farmers, for fear of loss from the depredations of the Pea Weevil, gave up growing peas altogether during the last two seasons. In 1903 the numbers of the Pea Weevil were perceptibly reduced, but no natural parasites such as frequently bring down the numbers of other insects when they increase unduly, could be detected to account for this. The winter of 1903-4 was more severe, both from its duration and the intensity of the cold than has been experienced for many years. There is no doubt that the cold weather destroyed many of the weevils which had emerged in the autumn and were hibernating around barns and buildings. It is probable, too, that many of those still remaining in the seeds through the winter were also killed by the cold. In some rather extensive experiments carried on during two or three years to decide whether there was any exact limit to the low temperature which could be borne with impunity by the Pea Weevil, I found that beetles exposed inside the pease, both with the skin of the pea intact or with the cell cap pushed off, were killed at between 18 to 20 degrees below zero, Fahr. On several occasions during last winter the thermometer dropped lower than 20 degrees below zero, Fahr., in those districts of Ontario where the best seed pease are grown. Mr. Geo. E. Fisher, a practical farmer and careful observer of insect life, writing from Burlington, Ont., on September 29, says: 'The pea crop here is now being threshed. It is a good crop and characterized by the entire absence of bugs. This substantiates my contention that cold weather settles the Pea Bug. I believe there will be a large acreage put in to peas next year.'

Prof. C. C. James, in his November crop report for Ontario, says: 'The round or common field-pea has not been widely sown during the past three or four years owing to the weevil or "bug." The yield and general quality of pease this season, however, will do much to restore confidence in the growing of this crop. The injury from weevil was comparatively slight, and a larger area of peas may be looked for next year.'

Mr. J. D. Evans, President of the Entomological Society of Ontario, who has made inquiries for me in Prince Edward county, one of the most important districts in Canada for the production of first-class seed and pease, writes on November 11: 'The Pea Weevil was not destructive at all this year; in fact, it seems to have entirely disappeared. There were none found at Picton, Bloomfield, Wellington, Trenton or Frankford. Mr. Cooper, of Bloomfield, and Mr. W. P. Niles, of Wellington, both well known to you as first-class men, report its apparent disappearance in the above-mentioned localities.'

I draw special attention to the great diminution in the numbers of the Pea Weevil at the present time, in the hope of inducing growers to avail themselves of this exceptional opportunity of pressing home their advantage now when the infestation is so slight, and when, therefore, every insect killed is of much greater importance in the conflict than when Pea Weevils are occurring in the incredible numbers in which they existed in Canada only three years ago. I again repeat that I can see no reason why the Pea Weevil should not be entirely wiped out in Ontario.

There are special features about the attack of this insect which render its control a simpler matter than is usually the case with injuries of an equal magnitude. The Pea Weevil is not a native of North America, and has no other known food plant than the cultivated pea, which, being an exotic plant, will not live over the winter in our climate if seed is left in the open field; consequently, every seed sown for the pea crop of the year must, before it is sown, have been under the control of some one by whom it could have been treated before sowing to destroy the contained weevil if it had one. Fumigation with bisulphide of carbon is a certain, effective, easy and cheap remedy, which is well known and can be applied by any one. If all growers of pease, will combine to do this this year, when on account of the cool season of 1904, it is not likely that many of the weevils have left the seed, by far the greater number of the Pea Weevils now remaining in the country can be destroyed before another season opens. This, however, alone will not be sufficient. The knowledge of the life history of the insect must be made much more widely known to farmers than is the case; for, notwithstanding all that has been written on the subject and the attention which has been given to it at farmers' institute meetings, I have received during the past season a great many inquiries as to the best means of treating pease before sowing; and further steps must be taken at the proper time of the year to spread more widely a general knowledge of the subject, so that those growing seed and sowing pease, may understand the reason why certain steps are advised. My recommendations are:

1. That all pease for seed should be treated before they are sown, whether the weevil is thought to be present or not, and that seeding should be as early as can be, so as to get the crop ripe and ready for treatment at the earliest possible season.

2. That pea-growers should harvest their pease as much on the green side as is safe, rather than, as is usually done, waiting until they are dead ripe. This has many advantages; not only is the straw of much higher quality for feed, but the seed is heavier and better for every purpose. The pease should be threshed as soon as dry enough, and then fumigated at once. The weevils will not have completed their growth and will have destroyed a smaller proportion of the bulk of the seeds than if they were left until later in the winter. It is certain that weevils in all stages of growth may be killed inside the pease by fumigating with bisulphide of carbon. Consequently, if growers will sow early and harvest and thresh a little earlier than usual, and either themselves treat their seed immediately or sell to the grain buyers, who for their own sakes will do this, much good must surely result. When for any reason pease cannot be treated at once or disposed of, they should be bagged up and the sacks tied up immediately so as to prevent the escape of any weevils which might emerge in the autumn. When the grain is required for feeding, and therefore it is thought not necessary to fumigate, pease should be ground as soon as they are dry enough; and, for the convenience of grinding and to prevent the meal from becoming musty, some old pease should be mixed with the new before passing them through the grain grinder.

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3. That everybody who understands the gravity of this question should use every endeavour to persuade all growers of pease to abstain from sowing any pease which contain living weevils, and, when purchasing seed, to refuse determinedly to buy any without an assurance from the seed merchant that they have been treated, and, even with this assurance, to examine for themselves to see that any contained weevils are really dead. There are two points which should always be remembered by those who purchase pease for sowing. Seeds which have been injured by weevil are so much reduced in vitality and producing power that they are only worth about one-quarter as much as sound seed, and also, that treatment with bisulphide of carbon in no way injures the pease, whether they are to be used for seed or to be fed to stock.

FIELD CROPS.

The irregular nature of the weather during the summer months of 1904, which has already been referred to under cereal crops, was manifested even more plainly by its effects upon fodder crops. Good hay crops were the exception, perhaps the best being secured in western Quebec and central and northern Ontario. Corn was nowhere heavy nor well developed. Complaints of poor seed were frequent; but it is possible that some of the disappointment was due rather to weather conditions than to lack of quality in the seed. Late spring frosts did some injury, and early frosts in autumn reduced very much the weight of ensilage corn per acre. The Ontario returns sum up the crop as follows:—'Corn for the silo is described by some as being of inferior quality, while many others claim that it will be good or of fair quality. Taken altogether, however, it has been a decidedly poor year for corn.' In the Maritime Provinces and Quebec some injury was done by cutworms, necessitating replanting and a consequent retarding of the crop, so that it was caught by frost in the autumn. The drought which prevailed from the Temiscouata district in Quebec to the sea coast reduced enormously hay crops, which up till the first of June were apparently in a flourishing condition. Writing of the climatic conditions in Prince Edward Island, the Rev. Father Burke says:—'The season opened with much promise, and there was more soil moisture than we have had for several years. The weather was warm and genial, and the opportunity for getting the crop in was unexcelled. Towards the end of June, however, the complete absence of rain began to be felt, and, as almost every day we had high winds from the south-west, growing crops became a greater concern to farmers. We had merely a few insignificant showers till away on to the last of September, so that grass and all forage crops were seriously affected. Hay was not half a crop, and grain in land not particularly rich in humus very poor indeed. We are exceedingly short of fodder, and the government is importing hay from Quebec to prevent the wholesale slaughter of cattle.'

A much brighter report comes from British Columbia, notwithstanding that large areas were affected by drought. Mr. J. R. Anderson reports grasses and clovers as giving 'good yields throughout the province, and on account of favourable weather hay was mostly well cured. Red clover, alfalfa, sainfoin and alsike in different localities gave some surprisingly large yields on irrigated lands, as much as three crops being cut in places. Timothy is largely grown, but its production is discouraged, as other grasses are preferable for pasture.'

Insect enemies of these crops were not complained of to any large extent; but this cannot be taken to mean that no injury was done. Enormous losses may be sustained in hay and fodder crops without farmers noticing the fact. Then, again, some losses have become so much a matter of every year occurrence that no mention is made of them in reports. This is particularly the case with the CLOVER-SEED MIDGE, to which I

have drawn attention very frequently. The annual loss at the present time is enormous, and yet, if those who grow clover seed practise the simple remedy of feeding off or mowing the first crop before June 20, the results are always so satisfactory that I cannot understand why the practice is not more generally adopted.

Mr. G. H. Clark, Chief of the Seed Division of the Department of Agriculture, who has exceptional opportunities of learning the condition of crops throughout the country, writes to me as follows:—

‘Ottawa, Nov. 30.—Referring to your inquiry about the condition of the clover seed crop for 1904, I have to say that our instructor in seed-growing for the province of Ontario has reported that, on account of the severe winter, the crops of alsike and red clover in June and later months appeared patchy, and, in consequence, a much smaller area was left for seed crop than in previous years. Mr. Newman also inspected fields of red clover that had been left for seed in nearly all of the districts where red clover seed is extensively grown, and found in practically every county that the crops had been badly injured by the midge. These conditions, together with the unfavourable weather for ripening the seed, would indicate that the clover seed crop of 1904 will fall considerably below the average.’

Further efforts will be made next season to draw the attention of the clover seed growers to this important matter; and it is to be hoped that a reduction may be made in the great amount of loss which is now taking place every year. Letters appeared in the newspapers last year at the end of June, advising the best steps to take and a few farmers followed them; but the result of the clover seed harvest of this year is very unsatisfactory. The plants in many places suffered from the severity of last winter, and there was a great deal of winter-killed clover in spring. Alsike seems to have suffered even more than red and mammoth clovers, and red clover in all parts of the province of Ontario was injured by the midge. In travelling over part of New Brunswick and in the Annapolis valley of Nova Scotia in June last, I found red clover in almost every section badly attacked by the midge.

THE CORN WORM (*Heliothis armiger*, Hbn.).—From time to time complaints are received from various parts of the country of more or less injury to sweet corn in autumn by the caterpillar of a noctuid moth, which is known by various popular names. It is what Professor Luger called the Sweet Corn Moth, or Tassel Worm, in Minnesota, and is also the same as the notorious southern ‘Boll Worm’ of the cotton, to which crop it frequently does great damage and for which it has been found very difficult to find a practical remedy. The name of widest use is the Corn Worm, although its injuries in Canada are not confined to Indian corn, for the caterpillars have also been found boring into the fruit of tomatoes and attacking many other plants. There is but one brood in the year in Canada, the caterpillars occurring in autumn and the moths from these emerging the following summer. The worst injury by this insect in Canadian crops is to the cobs of sweet corn, because the work of the caterpillars renders the ears unsightly and discoloured so as to be unfit for the table.

In 1898 there was a bad attack at Orillia, Ont., when as much as 95 per cent of the ears of both sweet corn and yellow field corn were injured. There were other outbreaks in the same year in western Ontario and at Ottawa. These caterpillars do not appear till late in the season, generally during the months of September and October, when they may be found of all sizes, eating the young grains near the tips of the ears, frequently as many as five or six caterpillars working in the same ear. As they approach full growth, when they are an inch and a half in length, they frequently eat their way out of one ear and attack another one.

The only account of injury by the Corn Worm this year comes from Nova Scotia, and is the first record I have had of injury by it in that province.

‘Mahone Bay, Sept. 7.—I send you under separate cover specimens of what is to us a new pest. It affects garden corn in the way you will see by the portions of severe-

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ral ears I am also sending. There are from one to three of the caterpillars in each ear, and, of about 45 ears picked by me, so far only five were free from them. This pest seems quite general here, and at least for eight or ten miles around. One man only, of all I have asked about it, tells me that his corn is not affected. After a while the caterpillars make a round hole through the husk and disappear, I suppose, into the ground, although I have vainly hunted for them in the ground about the corn roots.'

—CHARLES A. HAMILTON.

The caterpillar is somewhat variable in colour, and is from one and a quarter to one and a half inches in length when full grown. The head is honey yellow, and the body varies in colour from pale greenish to dark brown, and is marked with longitudinal dark stripes and with a conspicuous band along the sides where the breathing pores are situated. This band is white, mottled with pink. On the body are the ordinary tubercles which are found on noctuid larvæ. These are distinct and black, each one bearing a slender bristle. The upper surface is marbled irregularly with white, and the whole surface of the skin has a velvety appearance, owing to numberless very short bristles, which are black and white in about equal numbers. A single specimen, which turned out to be a caterpillar of this moth, was found in a greenhouse late in the year (October 28). It was full grown and buried in the ground on October 31. The jar containing it was kept out of doors for the winter, and the moth emerged on July 8 the following year. This caterpillar was remarkably unlike those occurring on corn the same year, being entirely dark velvety green, without conspicuous markings, and was feeding on the leaves of a scarlet geranium. This moth, however, is by no means a common species in Canada, and nearly all of the specimens I have seen have been taken late in the year. Prof. Luggar states that the insect does not winter in Minnesota, but that all are killed late in the fall. This, he points out, would mean that the insect has to be reintroduced every summer from the south, where it can successfully hibernate. Whether the insect also hibernates as a moth in Canada, I have been unable to decide, but it certainly passes the winter in some instances as a pupa, although the caterpillars vary so much in size late in the year that many of them must be caught by early frost, which destroys their food plant. The moth of this insect is somewhat variable in the intensity of colour, but is usually of a dull pale ochreous yellow, with olive or ruddy markings on the forewings. The yellowish hind wings have a broad blackish band, and are edged with pink. These moths expand a little more than an inch and a half from tip to tip of the opened wings.

The caterpillars of the Corn Worm are recorded as having been found on a great many different kinds of plants, including the following crops: Pumpkins, tobacco, beans and peas; and the full grown caterpillars seem to have a penchant for eating into any solid firm object, such as a fruit or pod of any kind.

Remedies.—Unfortunately this is a very difficult insect to keep in check. When it attacks corn, as described above, it is seldom noticed until a considerable amount of harm has been done. Where the caterpillars are troublesome regularly every year, growers, it is claimed, get into the way of recognizing at a glance, ears which are infested, by the discoloration of the silk earlier than is natural in perfect ears. As soon as an infested ear is discovered, the leaves of the husk are pulled back and the caterpillars destroyed by hand. Where, as in Canada, it is only at long intervals that harm is done in any one place, corn growers are taken by surprise, and the injury is done before it is noticed. It is claimed that many of the moths may be taken in lantern traps consisting of a lamp standing in an open pan containing water with a little coal oil on the top of it. Anyone, therefore, who knew the appearance of the insect, upon recognizing the moths in years of great abundance flying around lights at night, might place lantern traps as described above in his crop, and thus prevent future loss; but this insect, like many others which appear in an intermittent manner, will always be a source of trouble. On fields where a crop of corn is known to have been attacked by the Corn Worm, the old stems should be removed from the field as

soon as the crop is gathered, and the land ploughed deeply in autumn so as to break up the cocoons and expose the pupæ to the weather and their various enemies among the small birds and mammals.

The BLACK ARMY WORM (*Noctua fennica*, Tausch.).—This cutworm was found in small numbers at Ottawa, chiefly in gardens and clover fields, but no great harm was done. There was a serious occurrence of the insect at St. Emile de Suffolk, Que. Mr. Elsimère Guérin wrote on May 27: 'This spring I sowed 13 bushels of peas, which have been destroyed by the caterpillars of which I send you specimens. They are beginning to attack my oats. Can you tell me what I can sow in place of the peas without loss? Also, if there is anything I can use to destroy the worms?'

The samples sent were full grown specimens of the Black Army worm, which is a velvety black caterpillar with red head and legs and is striped down the back and sides with distinct but fine white lines. The dorsal area is sometimes more or less washed with a reddish tinge. There is a distinct white waved stigmatal band, washed with yellow and bearing in the centre an irregular black line. The lower side of the body of these caterpillars is a dusky green mottled with white. They become full grown about the end of May, when they burrow into the ground and turn to chrysalids, from which the moths emerge in July. In reply to Mr. Guérin's question, he was advised to leave the pea field and see if the plants did not recover, this having been our experience at Ottawa in 1891, when from a field similarly injured a heavy crop of peas was harvested. Later in the year Mr. Guérin wrote to me that he had reaped a heavy crop of peas from this field.

The COTTONY GRASS SCALE (*Eriopeltis festuca*, Fonsc.).—In the report of the Entomologist and Botanist for 1895, some account is given of a curious scale insect which has occasionally appeared in vast numbers in pastures and meadows in Nova Scotia and Prince Edward Island. From time to time specimens of the egg-sacks of this scale insect on grass (Plate I., fig. 4) are sent in for information, and apparently the species is not uncommon in the Maritime Provinces. During the past summer I observed small colonies in many places, and Mr. W. H. Harrington tells me that he also found them very abundant near Sydney, C.B. Mr. Charles Myers sent specimens from Lake Verd, P.E.I., with the statement that in many places, both in new meadows and on old sod, almost every blade of grass had one or more of the scales upon it.

This insect passes the winter in the egg condition beneath the scales. The young hatch in spring and feed on the leaves and stems of grass. The females become full grown in July, and towards the end of the month lay their eggs in conspicuous elongated oval sacks of closely felted downy white threads. As the eggs pass the winter upon the old grass, the burning over of pastures and meadows late in autumn or before growth begins in spring, would be an easy way of destroying this scale, should it at any time multiply so as to become injurious.

ROOTS AND VEGETABLES.

Both field and garden roots and vegetables have been to some extent affected by weather conditions in spring, and also have suffered considerably from well known enemies, but in most places they picked up well in autumn. Foremost among insect enemies were cutworms, which were extremely abundant and destructive in some parts of the Maritime Provinces, Ontario and the North-west Territories, and also in some places in British Columbia. The Turnip Flea-beetle did a great deal of harm in Nova Scotia, making it necessary sometimes to sow twice and even three times. Turnips

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in fields as well as in gardens were much injured by the ordinary Cabbage Root Maggot. The Onion Maggot was destructive everywhere. Beets and mangels had their leaves somewhat blistered by the mining larvæ of the fly *Pegomyia bicolor*, Wied., reports being received both from western Ontario and Nova Scotia; little harm, however, was done, as the attack stopped early in the season. The Turnip Aphis, Cabbage Aphis and plant-lice upon several other vegetable crops were numerous and destructive.

Potatoes were in most districts a satisfactory crop. The Colorado Potato Beetle was less aggressive than for many years, and no new enemies of prime importance were reported. The Potato Aphis occurred at Mahone Bay, in Nova Scotia, and did some harm; but this is an insect which so far has only appeared at long intervals. The Potato Rot has been rather prevalent and destructive. In Prince Edward Island 'the root crops were good—potatoes never better nor less attacked by pests of any kind.' (Rev. A. E. Burke.) At the Provincial Exhibition held at Charlottetown in September last, the exhibit of potatoes was simply wonderful, the tubers being even in size and remarkably free of blemish. In Nova Scotia the crop was a good average one, with little mention of rot. In Ontario there was a large yield, but considerable rot appeared, especially on heavy soil or on low land; the extent of the loss is variously estimated at from 20 to 50 per cent. In British Columbia, Mr. J. R. Anderson says: 'Potatoes are decidedly under the average in those sections where the best qualities are produced; fair on low lands; prices firm. The yield of other root crops is about normal, but short in some of the higher regions, although the quality is good.'

Spraying potato fields with Bordeaux mixture to prevent injury by the Potato Rot has again shown the great value of this useful remedy. Four sprayings on August 1, 15, 31 and September 14, gave potatoes absolutely free of all traces of disease. This was on light sandy land, and, as a rule, one or two more sprayings would be advisable. The saving from this treatment for Potato Rot is now so well established and so many object lessons have been given at fall exhibitions and on the experimental farms, that it is a most remarkable thing that more farmers and others do not practise such a simple method of saving a large proportion of their crop. Although, as with every other remedy, there is a variation in the amount of protection, in every instance that has come under my notice, and these have been many since we began to spray potatoes on the experimental farms, to show farmers what an excellent remedy it is—it has been invariably shown that spraying potatoes with the Bordeaux mixture to prevent Potato Rot always pays. Every year such demonstration plots have been grown since 1891, and, besides this, the Horticulturist and Agriculturist now spray all their potatoes as an economic method of obtaining as big a crop as possible.

The Potato Scab, another fungous disease which frequently disfigures and lowers the market value of potatoes very much, was also reduced to a minimum by soaking the tubers used for seed, before sowing, in a solution of 8 ounces of commercial formalin and 15 gallons of water.

CUTWORMS.—The larvæ of several species of noctuid moths known collectively under the name of cutworms (Plate I., fig. 1), as usual, did a large amount of harm in gardens, as well as, in some instances, in fields. By far the greater part of the injury was done by the Red-backed Cutworm (*Paragrotis ochrogaster*, Gn.), which is one of the widest spread and most injurious cutworms we have in Canada, appearing every year in greater or lesser abundance. It is not always possible to determine the species which is reported upon, but in most instances mentioned below actual specimens were received:

I was informed when in Prince Edward Island recently that, in almost all parts of the Island, cutworms had been most destructive last spring. Father Burke says: 'They were never more plentiful than last year and did a great deal of damage to all crops. Your poison bran remedy seems dangerous to apply where there are birds, fowls and other domestic animals about.'

Mr. A. McNeill, Chief of the Fruit Division, Department of Agriculture, writes on July 27: 'During my last visit to Prince Edward Island, I saw in many places, particularly in Queen's County, most serious deprecations by cutworms. Our July crop reports emphasize this and show that the root crops as well as garden truck have been almost completely destroyed by cutworms. I trust you will be able to think out some scheme to help farmers get rid of this enemy.'

Mr. Saxby Blair, Horticulturist at the Experimental Farm, Nappan, N.S., told me, when visiting the farm in June last, that this same cutworm had done a great deal of damage in his vegetable plots and in the flower beds. I advised him to use the poisoned bran remedy, and he now tells me that, as far as the cutworms are concerned, this was most satisfactory in checking them.

'Mahone Bay, N.S., June 28.—I send specimens of cutworms which are doing damage here. They cut off indiscriminately all kinds of vegetables. One of the specimens sent had just finished cutting off a potato stalk nearly half an inch in diameter. About ten per cent of my peas were taken, and other vegetables were injured. Some of my neighbours suffered somewhat more severely. These grubs, I notice, are becoming more common. Last year there were comparatively few, and the year before I saw none. Please tell me the species. I don't need other information as I find cutworms fully treated in your reports.'—C. A. HAMILTON.

'Tignish, N.S., June 30.—Cutworms are doing much damage in this part of Cumberland County. In my garden, with the exception of potatoes and sweet corn, they have eaten nearly everything.'—G. E. STOPFORD.

'Northport, N.S., July 6.—The cutworms I am sending are destroying cabbages, mangels, beans, &c., and are a perfect pest. What can be done to prevent their still growing more plentiful another year and to put a stop to the damage they are doing now?'—G. BRANDER.

'Forest Glen, N.B., July 1.—I send you specimens of grubs which have given us great trouble this spring in our garden. They eat off the bean stalks just as they come above the ground. After they had destroyed a great many of our early beans they attacked black currant and gooseberry bushes.'—J. BLEAKNEY.

'Hartland, N.B., July 4.—I am very much troubled this year with insect pests. Many of my plants are being cut off by grubs, and the trouble is general in this neighbourhood. In my garden, only cauliflowers and cabbages are attacked; but, with my neighbours, beans and tomatoes are badly destroyed. One man lost half his beans. I see that you recommend mixing bran with Paris green and sweetened water, putting a little of this round the plants. Is there any possibility of the plants absorbing enough of the Paris green so placed to render them unsafe for food?'—JOHN BARNETT.

'Batiscan Station, Que., July 8.—What can I do to destroy grubs that are eating up my onions, cabbages and other vegetables?'—M. SISSONS.

'Trenton, Ont., November 11.—The only instance of serious loss from insect enemies during the past season, which has come under my notice, was when I was at Coe Hill about midsummer. I learned of the almost total destruction of young cabbage plants early in the season by cutworms.'—JOHN D. EVANS.

'Calgary, Alta., June 20.—We are sending herewith some cutworms which are destroying all plants they come in contact with.'—HOLE & ANDERSON.

'Blackfalds, Alta., July 8.—Cutworms are very bad here this year. They have even started to eat off stalks of the potatoes.'—E. DALTON TIPING.

At Ottawa there was again this year a veritable plague of cutworms. My assistant, Mr. Arthur Gibson, took notes upon some fields which had been treated to save the crops from cutworms; and his observations confirmed us in the belief that the poisoned bran remedy, which I have advised so widely during the last few years, was on the whole the most satisfactory way of stopping injury by cutworms, and is a practical remedy equally applicable for crops growing in fields as in gardens. Mr. Gibson found in a field of tobacco which was being rapidly destroyed, that, by the second day after the remedy was applied, the destruction of the plants stopped entirely, and dead



Fig. 1.—A cutworm and its moth.



Fig. 2. The Plum Curculio: *a*, beetle; *b*, pupa; *c*, larva—natural size.



Fig. 3. The Plum Curculio: beetle—enlarged.



Fig. 4.—The Cottony Grass Scale: egg-sacks on grass—natural size.

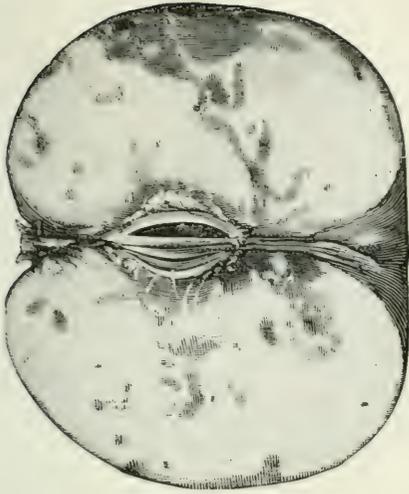


Fig. 5.—Apple infested by Apple Maggot.

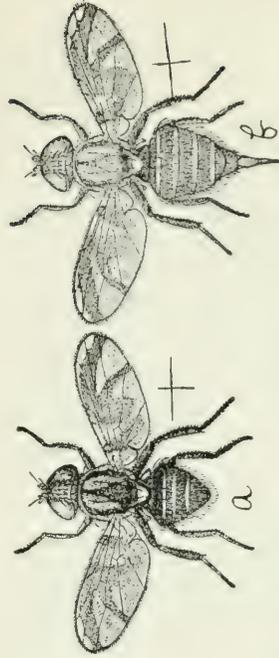


Fig. 6.—Flies of the Apple Maggot: *a*, male; *b*, female—enlarged.

(Figs. 2 and 3 kindly lent by J. M. Steedman, Columbia, Mo.; Fig. 6, by the N. H. Agr. Exp. Station.)

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or dying cutworms could be found by moving the soil lightly beneath every plant. By actual count, as many as nineteen were found under a single plant, and nearly as many under several others. This is only one instance of the very remarkable effectiveness of this remedy.

Remedy.—The poisoned bran mash is made by mixing half a pound of Paris green with fifty pounds of slightly moistened bran. In making this, it is best first to dampen some of the bran slightly with water containing a little sugar. After mixing thoroughly, add the Paris green by dusting it on the surface and stirring all the time. We have found that when Paris green is added to perfectly dry bran, owing to its weight, it will sink at once to the bottom when stirred, in the same way that it does in water. Half a pound of Paris green is enough to poison fifty pounds of bran, although double this amount may be used. If the mixture is too wet, more dry bran should be stirred in until the mixture will crumble easily and run through the fingers without adhering.

When required for garden use, all that is necessary is to sprinkle a little of the poisoned mixture by hand around such plants as are liable to attack. When crops are planted in drills or in rows, a convenient way is to make the mixture almost dry and then distribute it by means of a Planet Junior or other wheel seeder. In field practice, among such close growing crops as standing grain, which are sometimes injured by the Red-backed Cutworm, the poisoned bran remedy is also serviceable. The mixture can be distributed by means of a paddle or shingle and can be thrown easily to a distance of twenty feet. When distributed in this way, there is much less danger of chickens and birds picking it up than if it is placed in lumps.

The question of danger from the use of this poisoned bait is one which must be considered. It is frequently inquired about by correspondents, and some instances of the poisoning of poultry where it has been used, seemed to be justly attributable to their having eaten some of it. As a rule, there is little danger from this cause. The quantity used is so small that it is not noticed by poultry; and then, in gardens, poultry do so much harm to plants that they should never be admitted, at the time of year when cutworms occur injuriously and only at special times of the year when there are no crops to injure. If, however, there should be a bad infestation by cutworms and there is no means of barring out or driving away the chickens, the owner of the crops must decide whether he will lose his crop or take special means of protecting his chickens. The experience of a great many people who have used this remedy without taking any special precautions, is that injury to domestic animals is extremely rare; and, although I have been on the watch for any trouble of this sort for many years, I do not know of a single instance when poultry have been poisoned, without doubt by eating poisoned bran put out for cutworms. However, there will be many occasions when plants in gardens may be protected by putting out the poisoned bran in small heaps and then covering these up with a piece of shingle or some other covering, so that the material cannot be got at by stray chickens and other poultry.

It has also been asked whether there is any danger of plants absorbing Paris green from this mixture when placed near their roots. In reply to this, it is only necessary to point out that Paris green is practically insoluble and therefore cannot be absorbed by the plant.

ROOT MAGGOTS.—These insects, which every year are a serious tax on market gardeners, were in 1904 particularly aggressive, and from every province frequent demands were made for a practical remedy. Radishes, cauliflowers, cabbages, turnips, onions, and, in a few instances, beans and sweet corn were injured. Only a few years ago there were many districts in the West where root maggots were unknown; but of late years these have been invaded. Bad infestations are reported by Mr. N. H. Holland, from Norquay, Man., who speaks of his success in growing onions in former years, but now finds that he has this year lost a third of his crop and says that the maggots are get-

ting worse every year. Loss is also reported from Regina, Moosejaw and Calgary, as well as from many places at the coast, in British Columbia. In the Ottawa district these maggots were particularly destructive, and on the Central Experimental Farm Onion Maggots worked actively throughout the season from the middle of June till November, when they were destroying the ripe bulbs. The Radish Maggot was abundant in spring, and again in September. Cabbages and cauliflowers which were kept free from these enemies till the middle of July, were not afterwards injured. This was probably due to the hardening of the stems and the abundant root growth. Beans planted late and too deep in the soil were moderately attacked, but this is an unusual injury. Only one instance of corn being injured came to my notice, and this was from the seed having lain in the land for a long time and growth being retarded by cold wet weather. Several remedies were experimented with, but no very satisfactory results were obtained, except in the case of plants grown under a light wooden frame covered with cheese cloth, such as was mentioned in my last report. Under these protections, however, radishes and cauliflowers of high quality were grown which were perfectly free from the attacks of the maggot. Onions were too much drawn up by the shade and did not bulb well. I found that a convenient covering of this nature 8 feet long by 2 feet wide, and 2 feet high, can be made for about 25 cents, the frame being of light one-and-a-half-inch square wood simply nailed together at the corners and with cheese cloth tacked on on the outside. In a frame of these dimensions five cauliflowers and two rows of radishes were grown. The frame was kept on from the time the seeds were sown until the radishes were pulled. Cauliflowers were sufficiently advanced to require no further protection, and the frames were removed about the 1st of August. As a rule, the attack of the root maggots becomes perceptibly less by the first of August; and even late cabbages planted in July are seldom attacked by root maggots. During the season of 1904, the insect in all stages could be found throughout the season.

For plants grown in the open, the best results this year were secured from the following remedies:—

For Onions.—White hellebore dusted along the rows once a week gave comparatively clean onions, very few being attacked. In years when it is necessary to apply the remedy throughout the season, this would be too expensive to be considered a practical remedy. The Cook carbolic wash, which is very effective for radishes, was less so with onions. Pyrethrum insect powder, Bug Death, Paris green and plaster, used as dry powders, had little effect. Sand saturated with coal oil and Jeyes' Gardeners' Friend, were also tried this year without any decided results in saving onions from attack.

For Cabbages.—The remedies which have given the best results for cabbages are: 1. The Goff tar paper disks, which are pieces of ordinary tarred building paper three inches in diameter, with a slit running to the centre so as to allow of their being placed around the stems of the young cabbages at the time of planting. 2. About half a teacupful of a decoction of pyrethrum insect powder, four ounces to a gallon of water, poured around the roots of each plant after drawing away the earth, right down to the rootlets. The earth should then be pushed back again and hilled up round the stem. As a substitute for pyrethrum insect powder, hellebore was tried this year, not only at the Central Experimental Farm, but also by Mr. Saxby Blair, the Horticulturist at the Experimental Farm for the Maritime Provinces, at Nappan, N.S.. The results were very satisfactory. Mr. Blair writes: 'The Cabbage Root Maggot gave us considerable trouble last year; but this season their numbers were much greater and they proved very destructive to all the plots of cabbages and cauliflowers except two. These were where hellebore was used. This remedy exceeded all my expectations, and no root maggots could be seen around any of the plants in these two plots; indeed, they were the only good cabbages out of some 1,500 set out. The powder was mixed with water and applied with a force pump; I used two ounces to the gallon and four ounces to the gallon, and found the results of the two ounces just as good as where

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four were used. I am much pleased with this remedy, and, as far as one can judge from a single season, I am inclined to consider this a positive remedy for the root maggot of cabbages.⁷

Hellebore as a remedy for root maggots was first recommended to me many years ago, about 1888, by Mr. S. Greenfield, a successful gardener of Ottawa East; and I have found that, as a rule, it is a useful remedy. At Ottawa this year, as in previous years of heavy infestation, it provided considerable protection, but was not as perfect a remedy as Mr. Blair found it at Nappan.

For Radishes.—The Cook carbolic wash, consisting of one quart of soft soap, or one pound of hard soap, in a gallon of water, with half a pint of crude carbolic acid added, and the whole boiled together for a few minutes, to make the stock emulsion, has proved over and over again an excellent remedy for radish maggots. The stock emulsion can be kept in a closed vessel, so that dust and rubbish will not fall into it; and, when required for use, one part of this mixture by measure is added to fifty of water, and should be sprayed directly upon the growing plants from the time they appear above the ground, once a week until ready for the table. Applications of nitrate of soda, kainit and potash whale-oil soap, all of which have been from time to time recommended, proved to be quite useless at Ottawa.

It must still be acknowledged that up to the present time we have not secured a practical remedy for root maggots on onions. For radishes, which are ready to pull from five to six weeks from the time the seed is sown, the question of protecting them is much simpler than in the case of onions, which are growing throughout the season. The maggots of the first brood are nearly full grown and very destructive about the end of June; and, in some years, if the plants can be protected from injury up to that time, they are as a rule safe for the rest of the season.

There are some features about this attack which make it of interest to the entomologist. Some experiments have seemed to indicate the great value of a certain remedy, and then under other conditions this same remedy has proved comparatively useless.

For next year extensive experiments have been planned, and special attention will be given to this matter, which is one of great importance, both to the professional and amateur gardener from one end of the country to the other. From the limited experience we have had with the chees-cloth coverings, I have no hesitation in recommending these to amateur gardeners, however small their gardens may be, as a sure means of obtaining perfectly clean, as well as early, radishes and cauliflowers of the very best quality, at a comparatively light expense.

THE GREEN BLISTER BEETLE (*Cantharis cyanipennis*, Say).—Several kinds of blister beetles occasionally attack cultivated crops, and, unless driven off or poisoned, do much harm in an incredibly short time. Although in the larval state they are predaceous parasites feeding on the eggs of locusts, in the perfect condition they feed voraciously on vegetation. The Green Blister Beetle has not been previously sent in as a crop pest, but on June 15 last Mr. Richard Coates wrote from Cowley, Alta.:—'Enclosed you will find some insects which have come in numbers to my garden this year. They stay right with the beans and peas and soon destroy them.'

These beetles are long narrow insects, sometimes nearly an inch in length, of a most beautiful deep blue-green colour, which alight in large numbers and then may be noticed crawling quickly over the plants they are attacking and rapidly devouring the foliage. I have collected this species on the wild American vetch, at several places in western Assiniboia and southern Alberta.

CABBAGE AND TURNIP APHIS (*Aphis brassicae*, L.).—Reports of injury by this plant-louse have again this year been received from many and very distant localities. On the whole, however, I do not think it has been quite as destructive as usual.

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'Victoria, B.C., November 1.—Aphides of various kinds were in evidence. Swedish turnips and cabbages suffered severely from their ravages.'—J. R. ANDERSON.

'Cowley, Alta., October 19.—My vegetable garden is covered this year with a grayish-green insect, something like the green fly that attacks house plants. They began on the turnip tops, but now the Brussels sprouts are so covered that I cannot use them, and I can only use the large heads of cabbage which are too firm for them to get inside the leaves. Most of the cauliflowers were unfit for use from the same cause.'—F. W. GODSAL.

'Depot Harbor, Ont., September 12.—I send you samples of insects which are destroying my turnips and cabbages. What are they and what is the cure?'—J. F. PRATT.

Other Ontario occurrences which came to my notice were of fields moderately infested at Whitby and at Ottawa. There were a few reports from Quebec and from Prince Edward Island, and one from Mahone Bay, N.S.

The remedies are to watch for the beginning of the infestation when hoeing turnips and cabbages, and destroy the colonies either by spraying with kerosene emulsion or whale-oil soap, and the destruction or deep ploughing down of all turnip tops or refuse of cabbage beds in autumn, so as to destroy the eggs.

Although parasites are generally present in considerable numbers, they have not, as a rule, controlled this species so completely as is the case with many others. On the Ottawa fields, specimens of a parasite were present, which has been kindly identified by Dr. Ashmead, through Dr. Howard, as *Lipolexis (Aphidius) rapae*, Curtis. Dr. Howard says:—'This is a European species evidently introduced. We have it also from Michigan.'

PLANT-LICE of various kinds were complained of on many kinds of vegetables and root crops during the past season. Dr. C. A. Hamilton, of Mahone Bay, N.S., has favoured me with some interesting notes which he has made from time to time in his locality during the past summer.

POTATO APHIS (*Nectarophora solanifolii*, Ashm.).—Potatoes are not often troubled with plant-lice in Canada; but at long intervals outbreaks have been observed on this crop, and such a one occurred last summer at Mahone Bay, which was closely watched by Dr. Hamilton.

'Mahone Bay, June 28.—I send you some aphides from potatoes. These are apparently the same species as is now on my salsify and are abundant enough to have appreciably blighted my potato plants.'

'July 10.—There seem to be aphides on almost everything this summer, probably because of the abnormally dry season. Besides those sent, I noticed them to-day on squashes, cucumbers, broad beans, turnips, cabbages, beets and carrots, in fact, on almost everything I looked at.'

'July 14.—The aphid on my potatoes has overrun the whole patch, with the result that the potatoes have stopped growing and look very unhealthy. The blossoms have withered up and fallen, the lower leaves have turned yellow, and many others have turned black, just as if smitten with the blight, and are falling. They occur in immense numbers. Their favourite position is upon the peduncles of the flowers, which they cover completely. They are also found in large clusters on the stems and upon the under surface of the leaves. In many colonies there are a few flesh-coloured individuals.'

'July 15.—In *re* potato aphid, I to-day examined several plots near the village and found one field with about half the plants which had blossoms fairly well covered with aphid; other plants also had a few.'

'July 16.—The plant-lice on the potatoes are fast diminishing in numbers; but they have left the crop in a sorry condition.'

'August 1.—I send you to-day a last specimen from my potato plot. They have evidently been killed by a fungus. I first noticed its effects about a week ago on one

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corner, and it has since spread over the whole piece. Very few aphides are left alive. Since I last wrote, I noticed larvæ of lady-bird beetles and of *Syrphus* flies; but neither of these nor anything else had much effect in reducing the numbers of the plant-lice until this disease appeared. A month ago my potatoes could not have looked more promising. To-day I tried them, and out of six average hills I got 17 tubers, of which two only were large enough to be marketed.'—C. A. HAMILTON.

Remedy.—Should this plant-lice again appear in large numbers, infested plants may be freed of them by spraying either with whale-oil soap solution, one pound to six gallons of water, or kerosene emulsion, one to nine. These remedies would also be effective against the Colorado Potato Beetle, the Four-lined Plant Bug, Leaf-hoppers, and probably all other insect pests likely to be found on potatoes. They would not, however, probably be of any use against the Potato Rot fungus for which the Bordeaux mixture is such a useful remedy.

Aphis on celery, carrots and parsnips (*Siphocoryne*, sp.).—Dr. Hamilton sent also some aphides which he had found on celery, carrots and parsnips. It is probable that there were only two species concerned, and that both of these occurred on celery. Plant-lice are very difficult insects to send alive by mail, and, when put in alcohol or other preservative fluids, they lose their colour so much that they are not very suitable for study unless the species is well known. I am sorry to say that, notwithstanding much trouble taken by Dr. Hamilton in sending them, the specimens did not arrive in very good condition. They were, however, referred to Dr. Howard, Chief of the United States Bureau of Entomology, who reports under date July 17: 'Mr. Pergande has examined your aphides and says that 1 and 2 are species of *Siphocoryne*, apparently undescribed. The specimens on potato and salsify were rotten, but they appear to be *Nectarophora solanifolii*.* The two species of *Siphocoryne* referred to above were very different in appearance, and there seems to be little doubt that they are different species. The specific description of these, however, will have to be postponed until further material is available. I shall be obliged to any of my correspondents who may at any time find plant-lice on carrots, parsnips or celery, if they will forward them to me for study.

Injury to celery and parsnips by plant-lice I have never seen before; but the attack on carrots has come to my notice on two or three occasions previously, and has been one of considerable importance.

'Mahone Bay, June 28.—I send aphides from my celery, some have wings and some are without; but, as I always find them together, I take them to be the same species. The small wingless ones are extremely active, disappearing at a touch to the plant. This is the first time I have seen plant-lice on celery in the three years I have been raising that crop. Eight or ten days after I set out the young plants I found them swarming with these insects, and my neighbour's plants are the same. What I think are the same kind of plant-lice, I find also on near-by weeds, *Chenopodium album* and *Galeopsis tetrahit*. I had some carbolic acid and soap wash made up for root maggots. I gave them two sprayings with this and it cleared them out.'

'July 8.—I send a number of aphides with a few celery leaves, which I hope will reach you alive or at least in good condition for examination. It is very difficult to capture these, but by touching the plants with a piece of cotton batting they jump into it and become entangled. The specimens you ask for are in bottle No. 1. Bottle No. 2 contains another kind, I suppose, which are found rather sparsely on the underside of the leaf. In one of my letters I said that I thought that these insects had been brought here from Halifax on plants obtained by a neighbour. I do not think this now, as I find them infesting the celery of another neighbour who raised his plants from seed and who lives over half a mile from either of us. When first noticed, the insects were very plentiful, the celery was only an inch or an inch and a half high,

*Dr. Ashmead's description of this aphis is to be found in 'Canadian Entomologist', vol. XIV., 1882, p. 92

but each leaflet bore from six to ten aphides. They were scattered promiscuously over the plant, not clustered in any way. I sprayed my celery three times at intervals of a few days with the carbolic wash mentioned on page 182 of your 1903 report, with the result that the insects disappeared entirely each time for a day or two, then re-appeared, but in diminished numbers. Close observation to-day shows me that these plant-lice are on the celery bed, on the soil and plants of an adjacent salsify bed, one foot away, as well as a few upon beds of carrots; and they appear to be feeding on both of these latter plants. I cannot see that they have injured my celery very much, whatever they might have done, had they been left unchecked; still, they undoubtedly are feeding upon it, and perhaps the injury does not show, because the ground is very rich and the plants are well cared for. No. 2, however, whenever present, distorts the leaves, and, if present in larger numbers, would, I think, be very injurious.'

'July 10.—Aphides from Salsify : These are increasing very fast, and my plants are getting overrun, but you will notice that some of them are parasitized, having died and turned white. They are bound down to the leaf with a webby material which covers a small grub.'

'July 14.—Whitish fragments of dead aphides lying in abundance upon my carrot leaves and upon the ground beneath called my attention to them, and I found the new leaves had their petioles swarming with plant-lice. Although very plentiful, they do not yet seem to have done much harm. I find a few species of lady-bird beetles and some other predaceous parasites, of which I send you specimens. I have been more anxious for you to see these insects, because on looking over your reports I find no reference to either a potato or a carrot aphid.'

'July 15.—I find to-day that my parsnips are also infested by aphid. Please notice if these are not the same species as those on carrot; and those on potato look very much to me like those I sent you some time ago, which were found on salsify.'

'July 16.—The dark hopping aphid on celery has disappeared; but I send you more of the green ones from the underside of the leaves, with as many winged specimens as I can find. They have not been very plentiful on the celery, but seem to me very much like those from the carrots and parsnips. I find lady-bird larvæ very plentiful on my carrots to-day, and they are clearing off the aphides nicely. I have been much interested in watching these pests, and shall be obliged if you can send me the names of them : two from celery, one from parsnips, one from carrots, salsify, cabbage and potatoes.'—C. A. HAMILTON.

'Antigonish, N.S., Sept. 7.—My celery has been infested by a green bug. I inclose specimens and should like to know what it is and how to get rid of it.'—F. H. BEALS.

As stated above, there is still some doubt as to the exact identity of the species found on celery, carrots and parsnips. I shall, therefore, be glad to get specimens for further study.

The RED TURNIP BEETLE (*Entomoscelis adonidis*, Fab.).—In travelling through Manitoba and the North-west Territories in July last, I saw very few specimens of this beetle, which is sometimes a rather serious pest of cruciferous crops in the West; but some inquiries have been sent in as to its nature and habits.

'Edmonton, August 21.—Some gardens here are infested with a beetle somewhat like a lady-bird but bigger, which is bright red with black bars down its back and a spot on the collar, about three-eighths of an inch long by a quarter of an inch wide. This is doing some harm to radishes and turnips. In addition to this, some of the white turnips are terribly diseased this year.'—C. H. STUART-WADE.

The same insect was written about from St. Lazare, Man., by Mr. Louis Worms, who says that the insect had appeared in his district, and had been the cause of a good deal of discussion among farmers as to whether or not it was the Colorado Potato Beetle. He speaks of the leaves of turnips being entirely eaten or cut up into rags, and also that a large number of the turnips had rotted.

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Mr. Norman Criddle reports that 'The Red Turnip Beetle became rather troublesome last summer to cabbage, radishes, turnips and a few other garden plants. I noticed, too, that it had a preference for radishes in the seedling state. A few of these plants left to go to seed would, I think, make excellent traps for the beetles, and could be sprayed from time to time to destroy those which have gathered there.'

The PURPLE-BACKED CABBAGE WORM [*Evergestis (Pionca) straminealis*, Hbn.].—Occasional reports have been received at different times during the past ten years of the presence of short bristly caterpillars attacking cabbages and turnips in the Maritime Provinces. This injury was for the most part to turnips, and was generally noticed late in the season, the caterpillars congregating on the crowns of the turnips and eating cavities into the roots, as well as consuming the leaves. During the past season this caterpillar seems again to have been somewhat abundant, particularly on Cape Breton Island, whence Mr. E. J. Williams, of Little Bras d'Or, sent specimens, together with notes on the occurrence. He also reports that in some years whole fields of cabbage and turnips have been destroyed by these caterpillars. Among the specimens sent by Mr. Williams were a large number of half-grown larvæ of the Spotted Cutworm (*Noctua c-nigrum*, L.), which undoubtedly had been responsible for some of the injury described by him in the following note. Writing under date of October 24, he says:—'I am sending you some of the caterpillars I spoke of. They are very gregarious in their habits; they start under the leaves right on the ground but mine their way up to the head, tunnelling it hollow.'

In 1903 Mr. C. H. Young, of Ottawa, made some observations on injuries by this species upon cabbages near Old Chelsea, Quebec, twelve miles from Ottawa. The caterpillars, however, were not very numerous in this instance, and were not noticed to bore into the stems as mentioned above, but lay exposed on the leaves, and only two or three caterpillars were found on a single plant. Full-grown larvæ collected by Mr. Young on July 11 produced moths on August 8.

There is little reference to this species in the literature on injurious insects; but under the name of *Pionca eumusalis*, Walk., there is an account, with a good figure of the larva, by Thaddeus Harris in his Entomological Correspondence, page 322, stating that on October 30 and November 1, 1841, he had found larvæ on the leaves of horse-radish. He thus describes the attack: 'They eat large holes out of leaves, leaving finally only the veins untouched. They live beneath the leaves, stretched out by the sides of the midrib. They creep regularly, not haltingly, and move pretty fast. When alarmed or disturbed, they curl quickly and loose their hold and fall to the ground. Found the same on turnip leaves, October 20, 1844. Their ravages were considerable.'

The Purple-backed Cabbage Worm is closely related to the Cabbage Pionca (*Evergestis rimosalis*, Gn.), which is a well known pest of the cabbage and turnip. That species, however, does not occur injuriously in Canada. The following is a description of the caterpillar, and is made from the specimens sent by Mr. Williams:—

Body tapering slightly to each end; length, three-quarters of an inch by one-eighth at the widest part; head, a shield divided into two spots on the second segment, and a small plate at the end of the body, black. The general colour of the back, purple with a brownish tinge, the lower part of the body, pale greenish. The body is marked with the ordinary bristle-bearing tubercles and a rather conspicuous yellow band on each side, where the breathing pores are placed. The six tubercles above the side lines are rather more conspicuous than those below the lines and are of a deeper black. The tubercles are all black, but have white marks at their bases, which form a part of an indistinct network of lines over the whole upper part of the body. These lines are broken up into dots, or seem to be narrow, broken, thread-like longitudinal lines connecting the tubercles in each series. There is also an equally indistinct line which runs transversely across the middle of each segment, and one in each intersegmental fold, the whole forming an open network composed of two series of very indistinct but perceptible lines running at right angles to each other. The chief character by

which this caterpillar will be recognized from that of the Cabbage Pionea, is that its head is shining black, while that of the last named is yellowish.

The moth of the Purple-backed Cabbage Worm is a very neat little species, which expands seven-eighths of an inch. The upper wings are of a strawy yellow with a satiny lustre, and are marked rather distinctly with a heart-shaped discal spot, two distinct transverse waved lines across the centre of the wing, the inner of which runs through the middle of the heart-shaped spot, and two less distinct lines, one at the base and the other close to the apex. There is also a conspicuous dark blotch bearing a white crescent outwardly, towards the apex of the wing. The spaces between the transverse lines, especially on the nervures, are powdered sparsely with brown scales. The lower wings are silvery white, with a clear, broad black margin and a narrow submarginal line inside this. The fringes of the upper wings gray, of secondaries white.

The full life history of this insect is not yet known; but it passes the winter as a chrysalis in a closely woven cocoon, to the outside of which many particles of earth are attached. The moth emerges in the spring, and there are probably two or three broods in the season.

FRUIT CROPS.

The conditions affecting the value of fruit crops in Canada during the past season are peculiar. The apple crop has not been particularly large in most districts, but was of exceptionally good quality. Early apples were abundant, but the markets were poor and 'thousands of bushels of fall apples remained unpicked or were fed to live stock.'—(Ont. Crop Rep., Nov., 1904.) Winter apples were rather short in quantity and, notwithstanding the quality, the present prices are low, owing to the enormous crop of high quality apples in Europe, which discouraged shipments and kept the fruit in our own markets, glutting them and holding down prices. There was an unusually poor plum crop almost everywhere, except in British Columbia, where it is reported 'plums and cherries were up to the average; large quantities were sent to the North-west, and good average returns were realized. Small fruits also gave our growers good returns this year; raspberries were a fair crop, blackberries good, strawberries yielded well, and those shipped to the North-west and Manitoba arrived in excellent condition.'—J. R. ANDERSON.

The excessive cold of last winter seems to have affected somewhat nearly all of our fruit crops this year. Apples are everywhere reported as rather small in size. Many varieties were severely killed back on the young wood. The same thing, and to a greater degree, is reported of pears; and this fruit was also injured by drought in British Columbia, and Black Spot and Fruit Crack in Ontario. Strawberry plants nearly everywhere suffered from winter-killing. The heaviest loss to fruit-growers from the winter was in the great destruction of the peach orchards in western Ontario, and in the orchards of Northern Spys and Baldwins throughout the country. Grapes were a fair crop, but where not sprayed, were considerably injured by Black Rot (*Læstadia Bidwelli*, V. & R.), the Brown Rot (*Peronospora viticola*, De Bary), and mildew.

Injurious insects were fortunately not very aggressive in 1904. There was, of course, as is always the case, a certain amount of damage done by the regularly occurring pests of the orchard, such as Tent Caterpillars, Cankerworms, the Eye-Spotted Bud-moth, the Oyster-shell Scale, the Cherry Slug, the Imported Currant Sawfly, &c., for which standard remedies are available to all who wish to use them. These insects give no trouble in any properly looked after orchard, where the work is done syste-

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matically at the proper time and with due regard to the true value of each operation, where regular cultivation and spraying are done as a matter of course, and not as an exceptional expedient which some unusual occurrence has made necessary.

Mr. A. McNeill, Chief of the Fruit Division of the Commissioner of Agriculture's Branch of the Department of Agriculture, has kindly allowed me to examine the reports from his correspondents all over the Dominion; and in this way I have been able to learn many useful facts concerning the condition of fruit crops and the insect and fungous enemies which have affected them during the year. Mr. McNeill writes as follows:—'Our crop reports this year furnished us with a large amount of material bearing upon fungous diseases and insects. On the whole, it may be said that these enemies did not do as much harm as usual. There were, however, several sections where the Apple Scab (Black Spot, *Fusicladium*) was particularly bad. One of these was the western peninsula of Ontario, where it was difficult to secure any clean fruit except in well sprayed orchards. A curious condition prevailed in the Annapolis and Cornwallis valleys of Nova Scotia. One part of the valley was particularly free from fungous diseases, while in another these were decidedly prevalent. There were no serious attacks of insects, and indeed the year 1904 may be said to have been remarkable for the absence of injury by the Codling Moth. This exemption, however, must not be counted on for the future, inasmuch as there were still sufficient insects to propagate the species; and, with favourable conditions, there is no reason why the Codling Moth should not be prevalent again next year.'

Mr. J. R. Anderson writes:—'Victoria, B.C., Nov. 1.—Apples were good, but the yield was only average. Prices ruled high, and those growers who put their product on the market in good shape realized well. Fruit-growing is receiving much greater attention, as it is better realized that, with that care which is due to every branch of agriculture, a very superior article can be produced, with a corresponding profit to the grower. An exhibit sent to England from British Columbia was awarded the highest gold medal of the Royal Horticultural Society. This alone has stimulated the planting of orchards to an unprecedented extent.'

'Wolfville, N.S.—We have been singularly free from injurious insects this year; but Cankerworms and Tent Caterpillars are both on the increase, and there has been some loss from Eye-spotted Bud-mouth and Cigar Case-bearer, the latter of which is especially common in Annapolis County.'—F. C. SEARS, *Horticulturist, Department of Agriculture, Nova Scotia.*

'Alberton, P.E.I.—Our apple crop is large and cleaner than for many years, even in unsprayed plantations. The Black Knot on plums and cherries, wild and domestic, was bad.'—Rev. A. E. BURKE.

The following occurrences of insects injurious to fruit crops, among others, have been brought to my notice during the season and have received attention from the officers of the Division.

The SAN JOSÉ SCALE (*Aspidiotus perniciosus*, Cmstk.).—It is satisfactory to be able again to report that no new infestations by this insect have been reported beyond the limits of the area already invaded in 1903. It is probable that during the severe winter of 1903-1904 a large proportion of the wintering scale insects was destroyed. Among reports received, the following is of considerable interest, as coming from one who is specially able to observe and draw correct conclusions. Mr. Geo. E. Fisher, of Freeman, Ont., writes on July 10 last as follows:—

'The past winter was so unusually severe that I have been much interested in examining the condition of the San José Scale, to learn if possible the effect of extreme cold on this insect. Mr. Davis, of this place, for the past two years, has prepared about 100 barrels of lime and sulphur wash each year, which has been used by the fruit-growers in the district with such good effect that there is really little opportunity for investigation. However, I found a spot where the scale had been for some time, and had not been treated. I made weekly visits to this orchard, beginning about the

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middle of June. At that time most of the scale insects appeared to be dead, and, as I had found in my experiments, that the males were more easily killed by treating with various mixtures than the females, I hoped that the winter might have destroyed the males, and that there might be no breeding. The cold weather certainly reduced the scale very much indeed, only a small proportion being alive, and these developed slowly; but I find that some have reached maturity, and at the present time trees which last fall had a lot of live scale upon them, have larvæ in moderate quantity running on the twigs, some with new white cover scales just formed, and some which have reached the drab-coloured state. From what I saw in this orchard, I take it that breeding began about July 5 this year, or two weeks later than usual.

Although the San José Scale has not spread beyond its former limits, there is still a heavy and destructive presence of this insect in the orchards within the infested area. As misstatements with regard to this matter have frequently appeared in newspapers and elsewhere, it may be well to again repeat that the only part of Canada where the San José Scale is found is in the Niagara Peninsula and in the counties along the north shore of the western end of Lake Erie. Every care is being exercised by the Honourable the Minister of Agriculture to prevent any fresh importation from outside countries. The fumigation stations at Vancouver, B.C., Winnipeg, Man., Windsor and Niagara Falls, Ont., St. John's, Que., and St. John, N.B., are kept open in charge of competent men, who unpack, fumigate with hydrocyanic acid gas, and promptly repack and send on, all nursery stock which comes into the country. The fumigation with hydrocyanic acid gas, of the strength and for the time the trees are submitted to it in the government stations, is perfectly certain to kill every scale insect upon them.

A rigorous watch has been kept on every kind of nursery stock which could possibly bring in fresh importations of the San José Scale; and I have again this year the greatest satisfaction in reporting that no single instance has been brought to my notice of living scales having been detected on trees which had passed through the fumigating houses. The superintendents at all of the stations have done their work carefully and well, and no well-founded complaints have been received from importers, either as to the slight delay which must occur while the stock is being treated, or as to any injury to the trees during the necessary unpacking, handling and repacking. Careful experiments have shown that the formula used at our federal fumigation stations is thoroughly effective in killing the San José Scale, and does not in any way injure the stock submitted to the gas. The formula used is one ounce of cyanide of potassium (98 per cent), one ounce of commercial sulphuric acid (66° Baumé), and three ounces of water—exposure, 45 minutes.

In addition to the above, the provincial government of Ontario have strictly enforced an Act compelling nurserymen to fumigate every shrub and tree sent out by them from their nurseries, whether the San José Scale had been found in their nurseries or not. These firms have, wisely, acted well up to the letter of the law, and, while complying with the provisions of the Act, by sending out only first-class stock, have sustained their business reputation in the best way possible.

The federal fumigation houses are kept open, with a superintendent constantly in attendance throughout the seasons of spring and autumn shipments of stock. The fumigation seasons for the various stations are as follows:—

Vancouver, B.C.—October 15 till May 1.

Winnipeg, Man.—March 15 till May 15, and October 7 till December 7.

Windsor, Ont.—March 15 till May 15, and September 26 till December 7.

Niagara Falls, Ont.—March 15 till May 15, and September 26 till December 7.

St. John's, Que.—March 15 till May 15, and September 26 till December 7.

St. John, N.B.—March 15 till May 15, and October 7 till December 7.

The San José Scale Act and the amendments which have from time to time been made, are the result of an effort on the part of the Honourable the Minister of Agri-

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culture to help the fruit-growers of the Dominion by allowing them to import nursery stock of such new kinds of fruits as from time to time are originated outside of Canada, and which it is claimed by fruit-growers are necessary for the profitable prosecution of their business, but at the same time, to safeguard their interests in every possible way by taking such precautions as would make it practically impossible for any new infestation of the San José Scale to be brought into the country with the nursery stock. The whole expense of the different stations is assumed by the Dominion Government; but all shipments are made entirely at the risk of the shippers or consignees, the government assuming no risk whatever. The packages must be addressed by the shippers so as to enter Canada at one of the above-named ports of entry, and the route by which they are to be shipped must be clearly stated upon each package.

Many horticulturists and nurserymen have availed themselves largely of this concession, and at every point much stock has been imported from the United States and Japan. Nursery stock of all kinds can be imported from Europe without fumigation, as the San José Scale has never gained a foothold in European countries. Certain other plants which are not liable to the attack of the San José Scale are also exempted from treatment under the San José Scale Act. These are: (1) greenhouse plants, including roses in leaf which have been propagated under glass; (2) herbaceous perennials, including strawberry plants; (3) herbaceous bedding plants; (4) all conifers; (5) bulbs and tubers; (6) cottonwood (*Populus monilifera*), grown in Minnesota and the Dakotas.

Remedy.—Frequent inquiries are made as to whether there is a practical remedy for the San José Scale. I believe that it may now be justly claimed that the lime and sulphur wash made by any of the recognized formulæ is a reliable remedy for this insect. Orchards which have been carefully treated, are in better condition than they were at this time last year, and have borne during the past summer satisfactory and profitable crops of fruit. No remedy, however perfect it may be, will give good results unless great care is taken in applying it; and even with the lime and sulphur wash, it is not claimed that a single application will always give perfect results. Any remedy which does not cost too much for labour and materials, and which will ensure a paying crop, is certainly a practical remedy. All remedies will vary in the degree to which they secure the ends aimed at, and all that is claimed for the lime and sulphur wash for the San José Scale, is that up to the present, all things considered, this has proved the best remedy, and is, at any rate, as successful in its results as any known remedy which is used in medicine for controlling the diseases of animals or human beings. Success with any remedial treatment will necessarily always depend on the thoroughness with which it is carried out.

The making of the Lime and Sulphur wash is described with full details in my last report.

The Canadian wash is made by mixing lime and sulphur together in the proportion of twice as much lime as sulphur, and boiling these together in an iron kettle for two hours (or not less than one hour). The quantity of water added to make up the required amount of wash is largely a matter of convenience in using. When boiled with steam, barrels may be used, and to begin with, should be one-quarter filled with water and the steam turned on until the water is boiling; then turn off the steam and put in the lime and sulphur together as quickly as this can be done without making the mixture boil over. When the lime is all slaked, turn on the steam again, and leave the mixture boiling for at least an hour. In Mr. Geo. E. Fisher's outfit, which has been frequently described and has been figured more than once, eight barrels of wash were cooked at once, and he found that with steam at 80 or 90 lbs. pressure, the quarter barrels of water, before the lime and sulphur were turned in, could be brought to a boil in five minutes. Mr. Fisher secured the best results when each gallon of the wash contained one pound of lime and half a pound of sulphur.

The Oregon wash consists of lime 15 pounds, sulphur 15 pounds, blue vitriol 1½ pounds. Dissolve the lime and sulphur by boiling for one hour, then add the blue

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vitriol dissolved in hot water, and boil for fifteen minutes longer; fill up to 50 imperial gallons.

The California wash consists of lime 15 pounds, sulphur 15 pounds, salt 15 pounds, water 50 imperial gallons.

The Lime-Sulphur-Soda wash consists of lime 40 pounds, sulphur 20 pounds, caustic soda 5 pounds. In making, the 40 pounds of lime is placed in a barrel, and only enough water is added to make it boil rapidly. While slaking, 20 pounds ground sulphur, which has been made into a thin paste, is stirred in thoroughly; the five pounds of caustic soda dissolved in hot water is then poured in, with more water as needed, and the whole is kept stirred thoroughly all the time. As soon as all chemical action ceases, as shown by the absence of bubbling in the mixture, add hot water up to 60 gallons, and the wash is ready for use. The whole time necessary is twenty minutes.

Dr. E. P. Felt, the State Entomologist of New York State, has made a further modification in this formula, by which he substitutes ordinary washing soda for caustic soda and has secured equally good results.

In all of the above mixtures, it is best to use hot water, and to have the sulphur powdered so as to help the rapid combination of the constituents.

The lime and sulphur mixtures must only be used as winter washes while the trees are dormant, or the trees will be injured. The best time is late in spring, just before the buds expand. If necessary, they may be followed in summer by applications of whale-oil soap solution, one pound to six gallons of water, or kerosene emulsion in the dilution of one part in nine of water.

PLUM APHIS (*Aphis prunifolii*, Fitch).—The Plum Aphis was found rather abundantly on plum trees in Prince Edward Island, and Mr. Saxby Blair found it also troublesome in the orchards at Nappan, N.S. He writes: 'The pests that have worried me most are the plum and apple aphides. They are perfect nuisances. I thought I had them all controlled this year by early spraying, twice with whale-oil soap, one to six, but later on they appeared in myriads on some of the trees. It seems almost impossible to get men to spray their trees thoroughly enough to get at all of the plant-lice. Any information you can give about Plum Aphis will be useful to our fruit-growers; for this insect is becoming a general pest. Another thing is this: you advise whale-oil soap; now the average farmer in this country cannot get whale-oil soap. I tried to get some in this locality last summer, and they wanted 20 cents a pound for what they called whale-oil soap. If you can give in your report definite information where this soap can be procured, and what the usual price is, it would help. Could you not give instructions by which it could be made by the farmers themselves? I must say I find the whale-oil soap much easier and more convenient to use than bothering with tobacco water. Tobacco stems in most places are very difficult to get; but if whale-oil soap is just as good and can be got easily, that is what the average man will use. I find, too, that it takes much more liquid to do thorough work with tobacco wash than with a strong solution of soap.'

Remedies.—The standard remedies for plant-lice are soap washes and kerosene emulsion. Strange as it may seem, dark-coloured species of plant-lice certainly require stronger applications than the green kinds.

Kerosene emulsion in the dilution of one part to six of the stock emulsion has given good results against all kinds of aphides.

Soaps.—The most effective soap wash is made with whale-oil soap, one pound to from four to six gallons of water. The term whale-oil soap is merely a trade name for a fish oil soap, made with either potash or soda. The potash soaps, which are the best, because even strong solutions remain liquid when they cool, are soft soaps. The soda soaps are hard. Of the two the potash soaps are considered the best to use on vegetation, and they are more convenient to use. Both kinds should always be dissolved in hot water.

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When bought at retail prices these soaps cost from 15 to 20 cents per pound, according to the locality, but, if obtained in large quantities, can be got at from 3 to 5 cents per pound. Fifty pound kegs are supplied at 5 cents per pound. Two well known brands of potash soft soaps which have been much used in Canada and have given good satisfaction, are those made by W. H. Owen, of Port Clinton, Ohio, and by Good & Co., of Philadelphia, Pa. If thought desirable, these soaps can be made at home; but it is very unpleasant and dirty work, and it is besides doubtful whether such good or cheap results can be secured as by buying from firms which make a special business of manufacturing soaps with only the required amount of moisture and the proper grade and amount of potash. It has been found in experiments carried on at Washington that what is required for spraying purposes is a caustic potash and fish oil soap, made with a fairly good quality of fish oil and from which water has been eliminated by boiling, so that it does not exceed 25 or 30 per cent of the weight of the soap. Soaps made with caustic soda instead of caustic potash are unsuitable for spraying purposes. Dr. J. B. Smith, in his circular No. 5, 'Whale Oil Soap and its Uses,' says: 'Whale oil or fish oil soap is one of the most reliable materials for use against plant-lice, and generally against sucking insects which can be killed by contact insecticides. It kills by clogging the spiracles or breathing pores of the insects and also to some extent by its corrosive action. The advantages of fish oil over ordinary laundry soap lie in the greater penetrating power, in the fact that it remains liquid when cold at much greater strengths, and that fish oil itself seems to be more fatal to insect life than other animal fats. A good soap can be made as follows:—

Concentrated potash lye.....	3½ lbs.
Water.....	7½ gallons.
Fish oil.....	1 gallon.

Dissolve the lye in boiling water, and to the boiling solution add the fish oil; continue to boil for two hours, and then allow to cool. Any grade of fish oil will answer.'

The PLUM CURCULIO (*Conotrachelus nenuphar*, Herbst.).—The Plum Curculio made serious inroads into the sparse crop of plums of 1904. It was complained of in all localities east of and including Ontario, and was perhaps the fruit pest most mentioned by correspondents. Plums, apricots, cherries and apples were injured.

The injury of the Plum Curculio is known by sight by thousands of fruit-growers who have never seen the beetle to recognize it as the cause of the injury which they know so well on their fruit. The beetle itself (Plate I., figs. 2a and 3) is less than one-fourth of an inch in length, brown and rough, with black and gray mottlings, which give it a remarkable resemblance to a small piece of bark, and make it very difficult to distinguish. There is only one brood of this insect in the year; but perfect insects may be found at all times, because the beetles which emerge during August or September of one year, pass the winter as perfect insects under dead leaves, &c., and feed on the buds and leaves of plum trees early in the spring, and later during the season on leaves and fruit of various kinds; the old insects of the year before may often be collected at the same time as the newly emerged brood. When plums are about as large as pease, the crescent-shaped slit, with a small flap containing the egg, may be seen upon them. The egg hatches soon after, and the white grub (Plate I., fig. 2c) bores into the fruit, so that in the case of the plums they soon fall from the tree. The peach, apricot, cherry, apples and pears are also injured, but do not fall from the trees to nearly the same extent as plums. A great many more of the larvæ of the Plum Curculio come to full growth in plums than in the other fruits; the rotting of the fruit seems to be necessary for these grubs to mature. There is no doubt that by far a larger number of the grubs become beetles when they have fed in plums and cherries than in any other fruit. In apples, to which it causes serious injury also, from the disfiguring of the fruit, very few larvæ mature. By midsummer the larvæ are full grown and burrow a short distance into the ground, where they turn to pupæ, and the adult beetles emerge in August.

Apples badly disfigured were sent by Mr. C. L. Stephens, from Orillia, Ont., and similar samples were also received from two or three localities in Quebec province.

Remedies.—The remedies for the Plum Curculio are as follows: (1.) Spraying the trees early in the season so as to destroy the beetles which for some time feed upon the buds and opening leaves of plum trees. The second spraying, with poisoned Bordeaux mixture, should be made when the plums are about as large as pease. This will coat the young fruit so that the beetles are destroyed when they feed on the fruit or cut the crescents for egg laying. (2.) The destruction of all windfalls or injured fruit that drops, so as to clear away all fruit before the larvæ emerge and enter the ground to pupate. Poultry, pigs and sheep help well in this work. (3.) The ploughing up and cultivation of orchards so as to remove grass and other vegetation which, besides weakening the trees, gives places for the insects to hide in. The depth at which the larvæ pupate is about an inch beneath the surface, and the pupation in this part of Canada takes place during July; therefore cultivation during that month will destroy many of the pupæ, and this has been found the remedy which has given the best results in old orchards which had been in sod for many years and in which the fruit had been seriously injured year after year. (4.) The jarring of plum trees, which is much written about and highly recommended, will certainly destroy many of the beetles, but costs too much for labour when compared with spraying with insecticides, which give more certain results in my experience. As the plum and peach are rather easily injured by some arsenical poisons, arsenate of lead, 1 lb. to 50 gallons, is preferable to Paris green for these trees.

The APPLE MAGGOT (*Trypeta pomonella*, Walsh).—The Apple Maggot has never done much harm in Canada, although its injuries are very serious in the apple orchards of Main and some other States adjoining our borders. The slender white maggots, about a quarter of an inch in length, burrow in all directions through the flesh of attacked apples, feeding upon the pulp and leaving discoloured channels (Plate I., fig. 5). There are sometimes as many as a dozen maggots in a single apple, but even one is sufficient to render it worthless. The eggs are inserted beneath the skin of the fruit by beautifully marked black and white flies, with shining greenish golden eyes. The general appearance of the fly is shown in Plate I., fig. 6. In size it is about half as large as the ordinary house fly. There is only one brood in the year, and the eggs are inserted into the fruit by the females with a sharp ovipositor. Egg-laying takes place from the beginning of July until autumn. The young maggots become full grown in about six weeks, and their work, as a rule, causes the fruit to ripen prematurely and fall to the ground, when the maggots work their way out and enter the soil for a short distance, where they change to pale-coloured puparia, but inside which they remain as maggots until the following spring. The pupa forms only a few days before the perfect insects appear the next summer. The maggots of late-laid eggs are frequently in the fruit at the time it is picked, and these develop, destroying the fruit more and more as they grow. Apples apparently sound when gathered may, by the presence of eggs or young larvæ, afterwards become perfectly useless. The development of the maggot is slower in late and hard fruits.

In September last I received from Mr. R. W. Shepherd, the well known apple shipper, of Como, Que., samples of infested Fameuse apples, with the following information:—

‘Montreal, Que., September 26.—I mail you to-day specimens of Fameuse apples taken from one of my orchards, an old one, which show serious blemishes. There is some disease unknown to me which has affected some of the Fameuse trees in that orchard. The outside skin of the apples shows dents, and, when the apple is cut open, there are brown punky spots in the flesh; the fruit is generally undersized, and in any case is practically worthless for sale. No other varieties are affected here, as far as I have been able to learn; but there are some other orchards which are suffering in a similar way to my own.

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'October 10.—It is only my old orchard, which has been replanted at different times, that is badly affected. I have pigs there eating up the fallen fruit. I do not notice the maggots affecting any other variety than Fameuse, and in that orchard there are St. Lawrence, McIntosh Red, Scott's Winter, and other varieties. I noticed this injury last year for the first time, when the Shiawassee Beauty was affected. At that time I thought it was a fungus affecting the inside of the apple.

'October 20.—I am glad it was right to put pigs in the orchard; and, as they do not eat up the apples fast enough, I have given instructions that a herd of cows should be put in every day to make sure that all the fallen apples are done away with.'—R. W. SHEPHERD.

'Como, Que., October 25.—I thank you very much for your annual report. I am glad to have it, and hope to profit by your suggestions. Last year was the first time we noticed the Apple Maggot in our fruit; but it has increased a good deal this year. The McIntosh Red does not seem to have been troubled like the Fameuse, but Russets have.'—M. L. GIBB.

In addition to the above occurrence, apples from St. Hilaire, another celebrated locality for the production of first-class Fameuse apples, showed slight infestation. Como is thirty miles west of Montreal, and St. Hilaire twenty-three miles east.

Early and subacid varieties of apples seem to be preferred; but all varieties are said to be liable to attack, including late and winter varieties. When the late varieties are infested, the maggots do not emerge until some time during the winter after the fruit has been stored, the larvæ emerging and the pupæ forming inside the barrels or bins. The destruction of these pupæ and of all fruit when it falls to the ground during the summer and autumn constitutes the most reliable remedy for this injurious insect. The fallen fruit may be collected by children and fed to stock; or sheep and swine may be turned into the orchard from about the middle of July. Poultry will destroy many of the maggots and puparia beneath the trees. Late autumn ploughing will throw up many of the puparia to the surface of the soil, where they will be destroyed by birds, &c. Although the Apple Maggot has never done very much harm in Canada, the losses in Vermont, Maine and parts of New York State are sometimes extensive, occasionally amounting to 50 per cent of the fruit; and, as the injury does not show much on the outside, the uncertainty as to whether fruit is attacked or not renders it useless for sale. It may be well to point out here that, as the egg is inserted beneath the skin of the apple by the female fly, spraying with arsenical mixtures is quite useless as a remedy for this insect.

CODLING MOTH (*Carpocapsa pomonella*, L.).—One of the striking characteristics of the season of 1904 is the absence of injury by the Codling Moth, and this seems to be the case in all the fruit-growing districts of the country. I fear that this state of affairs may have an injurious effect by inducing many to give up spraying their orchards for the control of this pest. The absence of the Black Spot disease of the apple in 1903 had just this result during the past season. In some orchards which were free from disease in 1903, no spraying was done this year, and, as a consequence, what might have been beautiful crops have been ruined. Fungous diseases, although not caused by climatic conditions, are checked or developed enormously in accordance with favourable weather conditions or the reverse. The fruit-grower who is a good business man, has learnt before this that there is no longer any question as to whether spraying pays or not. That it does, is manifest every year by the predominant excellence of the fruit from all orchards which are sprayed, both as to insect presence and as to injury by fungous diseases. Mr. R. W. Shepherd, of Como, Que., and other buyers of the very best apples for the European market, assure me that, when purchasing the high quality fruit they require for that purpose, they cannot afford to waste time even in looking at orchards which have not been sprayed.

Although the Codling Moth was less destructive than usual this year, the presence of the eggs on apples and of the larvæ in fruit could be detected if closely looked for.

The weather throughout the past season has been such that insect occurrence of all kinds has been markedly less than has been the case for the last thirty years, so that the small numbers of the Codling Moth larvæ seen this year must not be taken as an indication that this most injurious enemy of the apple has disappeared to such an extent that spraying for it is no longer necessary. Moreover, it must be remembered that, by spraying apple trees at the times advised, viz., just when the buds are bursting and once a fortnight for two months afterwards, not only is the Codling Moth kept in check to the extent of saving an average of from 75 to nearly 100 per cent of the fruit, from its ravages, but also a great many other insects as well as fungous diseases are destroyed, giving the fruit-grower an enormous profit, compared with the cost of spraying.

GREEN FRUIT WORM (*Xylina*, sp.).—When examining orchards at Gagetown in New Brunswick, as well as in the Annapolis Valley and other places in Nova Scotia in June last, I frequently came upon the larvæ of a *Xylina*. These caterpillars, of which there are many species very similar in appearance, are known by the name of Green Fruit Worms, and have the habit of gnawing large cavities in the sides of apples, as well as devouring the foliage. The perfect moths from these caterpillars emerge in the autumn, and after passing the winter as such, lay their eggs on the trees in spring. The best remedy is the regular spraying of fruit trees with the poisoned Bordeaux mixture.

THE RED-HUMPED CATERPILLAR (*Schizura concinna*, S. & A.).—This caterpillar feeds upon a great many different kinds of trees besides the apple, and is seldom destructive except upon young trees. The eggs are laid in clusters, and the caterpillars are gregarious throughout their lives. Mr. E. P. Venables, of Vernon, B.C., reports that they were numerous in his locality last summer and did much damage in young orchards, in many cases the whole foliage being stripped from infested trees. He detected a hymenopterous parasite which was doing good, and is now rearing specimens so as to learn the identity of this useful insect.

THE SHOT BORER (*Xyleborus dispar*, Fab.).—There were several complaints from fruit-growers in the Annapolis Valley, N.S., of injury to apple and plum trees by the small wood boring beetle, which has received the name of the Shot Borer (Plate II, fig. 7). There has not been much complaint concerning this insect since 1897, but last spring its work was noticed in many places in the above district. The attack consists of a small black burrow (Plate II, fig. 8), beginning generally at a bud and running right round the stem inside the wood and near the bark of young living trees. Inside this there is often another burrow, and then a short perpendicular shaft at right angles running down the centre of the twig or branch. There is variation in the nature of the tunnels, according to the size of that part of the tree where they are located; but they are always about one-sixteenth of an inch in diameter, and if in a small branch or stem form a circular gallery with an ascending or descending perpendicular shaft, which serves as a brood chamber. When, as is sometimes the case, they occur in trunks of young trees of moderate size, from 4 to 6 inches in diameter, the galleries are straighter and simpler. These galleries are the homes and breeding chambers of the larvæ and their mother; for, although this insect is the cause of much injury to trees, with the exception of the wood which is gnawed out to make the tunnels, the tissues of the wood are not eaten either by the mature beetles or the larvæ; but the tunnels form caves within which a special kind of fungus is cultivated by the beetles as food for the larvæ, which simply lie in a small cell and feed or are fed by their parents on the fungus as it grows. An account of these beetles and their method of feeding upon the 'ambrosia' is most delightfully described by the late H. G. Hubbard, in an article entitled 'The Ambrosia Beetles of the United States,' one of the most charming narratives to be found in the literature of Economic Entomology. (See Bulletin No. 7, n.s., U. S. Division of Entomology.)

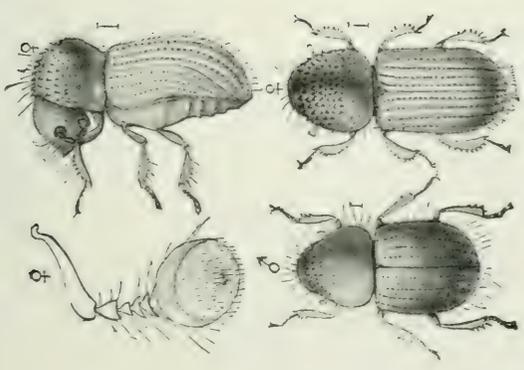


Fig. 7.—Shot borer; ♂ male; ♀ female—enlarged; antenna of female—more enlarged. (Figs. 7 and 8 from H. G. Hubbard, U.S. Dept. of Agriculture.)

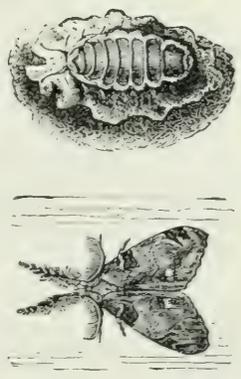


Fig. 9.—The White-marked Tussock-Moth male, female and caterpillar.

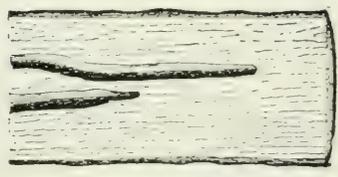


Fig. 8.—Gallery of Shot-borer in twig, cut across and lengthwise.

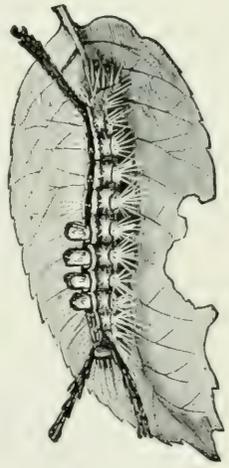


Fig. 10.—Branch of Canada Balsam Fir, with roots from base covered by sand. (Photo. by F. T. Shutt.)

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The remedies for this insect aim at either filling up the entrances to the holes in which the broods are being reared, so as to suffocate the larvæ, or in applying some liquid which will penetrate and destroy the fungous food or the larvæ and mature beetles while in the holes. For this purpose, kerosene oil and carbolic washes have been used with success; crude petroleum could probably be used with even greater effect, as on account of its extreme subtilty it would penetrate the burrows more deeply than most liquids, and also would act as a deterrent wash which would keep the mature beetles away from the trees when seeking places to make their breeding burrows.

The carbolic wash which has given good results in Nova Scotia is soft soap, 1 gallon, water 3 gallons, crude carbolic acid $\frac{1}{2}$ pint; the trees to be washed two or three times when the beetles are known to be prevalent. A difficulty with this insect will be found in the intermittent nature of its occurrence. As it is pretty sure to be present in some numbers in the same orchards where it was troublesome last spring, it will be wise for the owners to spray or wash their trees with a deterrent wash next season. Trees noticed to be badly infested at the time of winter pruning should be cut out and burnt before the beetles appear in spring, unless considered to be of special value, when they may be treated.

The BLACK VINE WEEVIL (*Otiorynchus sulcatus*, Fab.).—This weevil seems to have become a regularly occurring pest in gardens around Victoria and some other places on Vancouver Island, and also near New Westminster and Vancouver on the mainland. It is a black snout-beetle, three-tenths of an inch in length, of a dull black, the wing cases being deeply grooved and spotted with fine white points. The grubs are yellowish white, with dark heads, and have the body somewhat curved; they feed on the roots of several kinds of plants. These beetles have no true wings and the two wing-covers are connate or joined together in the middle, so their only means of spreading from place to place is by crawling. The beetle occurs near the coast on both sides of the continent and is sometimes a destructive pest in strawberry beds in Nova Scotia and British Columbia. The plants which have been reported to me as injured by the Black Vine Weevil in Canada do not include the grape vine; the name Black Vine Weevil is taken from European publications, where it is the recognized popular name, and will answer here until a better is suggested. The grubs probably do more harm than the adult weevils and have been found attacking the roots of Cyclamens and other plants in greenhouses, particularly Gloxinias, Primulas and Maiden-hair ferns. The most important injury so far recorded against this weevil is of its attacks upon strawberry beds. Mr. J. R. Anderson, reporting on the insects of the season, says 'the Black Vine Weevil did a considerable amount of injury to strawberry beds. This was principally on the lower Fraser. It also attacked the roots of Primroses in some localities.'

'New Westminster, B.C., May 30.—The Strawberry Weevil (*Otiorynchus sulcatus*) is very bad in several places this spring, and I find that in every case where strawberries are infested, they have been planted on land where the sod had been turned in previously, and that in neighbouring patches where no sod had been turned in they are comparatively few.'—W. D. DASHWOOD-JONES.

'Victoria, B.C., May 30.—I send you specimens of larvæ and pupæ of an insect which is in large numbers in a strawberry bed at Esquimalt, near here. I take these to be *Otiorynchus sulcatus*; am I right? There are many complaints of injury to strawberry plants this spring from this or a similar pest, chiefly along the Fraser at Hammond, Haney and Mission, but also in the Victoria district.'

'June 13.—I will send you further specimens of *O. sulcatus* from Mr. Fleming's garden near Victoria, and I will also try and get you other specimens from the lower mainland, where by the bye, I am told by Mr. Cunningham that there are two distinct species of weevils infesting strawberry plantations.'

'June 20.—I send you a box containing specimens of weevils, principally in the pupal form, but also including some beetles which were taken from strawberry fields

at Hammond. You will see that there are two species, one much smaller than the other. From the appearance of the infested plants, I take the larger specimens to be either *Tyloderma fragariae*, or *T. foveolatum*. Will you kindly identify and suggest remedial measures?—R. M. PALMER.

The specimens sent forward by Mr. Palmer were extremely interesting, and showed distinctly the work of two different insects which attacked the roots in a similar manner, but could be easily distinguished. All the plants sent were old plants, with large crowns, from a stout caudex; and it was into this that the larvæ bored from the outside, leaving large cavities, and in some instances destroying the whole of the interior of the stems. By the time the parcel reached Ottawa, most of the specimens were pupæ, and from these a little later I reared several specimens of the Black Vine Weevil and of the SLEEPY WEEVIL (*Otiiorhynchus ovatus*, L.). This latter is a common weevil, and is a curious slow moving creature, which is frequently found in out-of-the-way places. It may always be found out of doors at almost all times of the year, when sifting moss or leaves to collect beetles. It frequently penetrates into houses, sometimes in large numbers, and it has even been accused, with every appearance of good reason, of having inflicted very painful bites on campers sleeping in tents during the summer time. It occurs commonly throughout Canada east of the prairies, but I had not heard of it previously from British Columbia. The Sleepy Weevil has occasionally been accused of injuring potatoes, and Mr. P. J. D. Edmonds sent me from Summerville, P.E.I., specimens with potato leaves, and the following note: 'I send you a sample of a new kind of potato beetle, showing the way he folds himself up after cutting off the branches of potatoes. Please let me know what this is, and whether he is doing damage or how he can be destroyed. I did not actually see this field, but I am told that many of the stalks are stripped bare of leaves.'

The Sleepy Weevil is only about half the size of the Black Vine Weevil, and is of a dull pitchy brown colour, smooth and without any markings. It is always a very slow moving beetle, and it is probable that some injury may have been attributed to it for which it was not responsible. From its habit of hiding in dark corners, folded leaves and in hollows, it is frequently found in close proximity to injury which may have been done by other culprits. There is now no doubt that the larvæ feed on the roots of strawberries, and it is probable that they also attack the roots of many other plants. I have frequently found the beetles in old grass fields, and I shall not be surprised, especially after the observation made by Mr. Dashwood-Jones that strawberry beds planted on sod were most injured by weevils, to find that the usual food plant of both the Sleepy Weevil and its larger companion, the Black Vine Weevil, may be the roots of grasses. Should these insects become abundant in strawberry beds it will be well for growers to adopt the one-crop plan which has been used very successfully by Mr. Macoun, the Horticulturist of the Central Experimental Farm, and was adopted many years ago by Mr. Peter Dempsey, at Trenton, Ont. This consists of setting out new beds of strawberries in the spring, cultivating these for the first summer, taking one large crop of berries the next spring, and then ploughing the plants up as soon as the crop is off. In the meantime a new bed will have been set out from the runners of the bearing bed early in spring before the fruit ripened. This plan of strawberry culture not only prevents loss from the attacks of such enemies as the White Grub and the above-mentioned Weevils, but is also a paying operation, giving better returns from the higher price secured with the large fruit thus grown than from a large crop of smaller berries.

Both of the weevils here treated of are nocturnal, doing such injury as is attributable to them at night and remaining quiet by day, hidden away in crevices or beneath rubbish and other shelters. They can, therefore, be trapped in considerable numbers by placing objects about the beds convenient for them to hide in by day, and also easy of examination for the destruction of the beetles.

FOREST AND SHADE TREES.

No widespread or extensive injury to forest or shade trees was brought to my notice during the past season, but there were many inquiries sent in with specimens for information concerning these insects.

TENT CATERpillARS of several species, which a few years ago were so enormously abundant, but which everywhere suddenly decreased in 1900, seem to be again increasing in certain districts, not only on forest trees, but also in orchards. There is some confusion as to the species mentioned in reports; but western references are probably to *Malacosoma (Clisiocampa) californica*, Pack., and *M. americana*, Fab., northwestern to *M. disstria*, Hbn., and *M. fragilis*, Stretch, and eastern to the Apple Tree Tent Caterpillar, *M. americana*, and the Forest Tent Caterpillar, *M. disstria*.

Mr. J. R. Anderson says:—

Victoria, B.C., Nov. 1.—The Tent Caterpillars again appeared in larger numbers than usual this year. In some localities on the lower Fraser and in those places where no steps were taken to check their ravages, fruit and ornamental trees were utterly defoliated, and this was also the case with trees and bushes on the roadside.

When travelling in northern Alberta last summer, holding meetings with Mr. T. N. Willing, the Territorial Weed Inspector and Entomologist, I found, on July 21, two destructive colonies of what I took to be the Forest Tent Caterpillar (*M. disstria*). The first one was in a bush of many acres of Aspen Poplars, a few miles out of St. Albert. The moths were in thousands and were just emerging from the cocoons. Only a few dipterous and hymenopterous parasites were noticed at large or detected by their larvæ in the cocoons. The second colony was close to the town of St. Albert and was less extensive than the first one referred to, the chief injury being done on the tops of young aspen trees. Earlier in the season Mr. Willing sent me specimens of the larvæ of *Malacosoma fragilis*, Stretch, which he had found abundant on rose and other bushes at Medicine Hat. There are a few reports of injury by Tent Caterpillars in orchards and wood lots in western Ontario; and I hear from Nova Scotia that Tent Caterpillars are evidently again increasing in numbers.

The remedy for all these species, where practicable, is prompt spraying as soon as the young caterpillars appear, with poisonous mixtures.

BASSWOOD LOOPER [*Erannis (Hibernia) tiliaria*, Harris].—Mr. T. N. Willing found caterpillars of this eastern moth very abundant on the flat north of the south branch of the Saskatchewan at Medicine Hat. They were stripping the Negundos or Ash-leaved Maples (also called Box-elders in the United States), and skeletonizing all the leaves on some trees over an area of more than two acres. A moth was reared from these caterpillars, which like the larvæ, did not appear to differ in any way from eastern specimens.

THE NEGUNDO TWIG-BORER (*Proteopteryx willingana*, Kearf.).—For many years the Ash-leaved Maples grown at Winnipeg, Brandon, Regina and other points in the West as street shade trees, have been injured every season by the caterpillars of a small moth, which burrow in the bases of small twigs and branches, and hollowing these out, cause them to swell and form elongated galls. These have occasionally been reared, and some years ago moths were sent to a specialist who identified them as *Proteolera asculanum*, Riley. Under this name the insect has been referred to until the present season, when several specimens were reared by Mr. T. N. Willing, of Regina, and were forwarded to Mr. W. D. Kearfott, a specialist in microlepidoptera.

(See 'Canadian Entomologist,' vol. xxxvi., 1904, p. 306.) After careful examination they were decided to be an undescribed species, which was named in honour of Mr. Willing, as a recognition of the excellent work he is doing in working up the natural history of the North-west Territories. The caterpillars attain full growth during June and then leave their burrows in the twigs, and penetrating a short distance into the ground, spin close cocoons from which the moths emerge early in July. Some caterpillars of this moth, however, reared here in the Division of Entomology, pupated in the twigs where they had been feeding. It cannot be said that this insect does very serious injury to the Negundos; but it is sometimes extremely abundant and by destroying shoots makes it difficult to train these favourite trees in the way desired by those growing them as shade trees.

The NEGUNDO PLANT-LOUSE (*Chaitophorus negundinis*, Thos.).—As might be expected from the enormously extended area over which the Ash-leaved Maple or Box-elder is cultivated of late years, the insects which attack it are gradually spreading from the west with their host plant. One of the most troublesome of these is the Negundo Plant-louse, which for many years has been a disgusting pest of shade trees in the West, covering the trees with honey-dew during the summer and making them very unsightly objects instead of ornaments, in the streets, by reason of the copious growth of the Sooty Fungus (*Fumago salicina*), which always develops as a consequence of their attack. From several points in Ontario during the past summer, even as far east as Ottawa, this plant-louse was reported upon the Ash-leaved Maple trees. When not controlled by spraying with kerosene emulsion or whale-oil soap solution, these plant-lice do serious injury to the trees they infest; and they are so persistent in their attacks that many lovers of trees in the West have given up the cultivation of the desirable and quick-growing Negundo, for other trees less subject to insect attack.

The ASPEN BEETLE (*Lina tremulæ*, Fab.).—Mr. Norman Criddle, of Aweme, Man., writes: 'These beetles, which three or four years ago were so enormously abundant and did so much harm by stripping the aspen poplars, are once more on the increase. They were especially destructive to the young shoots of the aspens, causing many young trees to die.'

In 1900 and 1901 this beetle was so abundant and destructive on the prairies that many miles of beautiful aspen poplars so useful in that country for firewood and shade, were stripped bare of foliage, and a great many of the trees died. This was particularly the case in the Tiger Hills, Man., and in the Moose Mountain and Qu'Appelle districts, N.W.T.

WILLOW BEETLES.—For the last three years willows in the prairie provinces and in British Columbia have been very much injured by the small chrysomelid beetle, *Galerucella decora*, Say. This is a small brown beetle, soft, and rather flat in shape, which, both in the perfect and larval states, feeds on various kinds of willows, stripping the green surface of the leaves and leaving the bushes seared and brown. Mr. Criddle says: 'Willows at Aweme were completely stripped by these beetles and their larvae. Later in the season, aspen poplars (*P. tremuloides*) were also attacked by the same beetles to such an extent that any one knocking a tree would shake down countless numbers from the leaves, which sounded, as they fell on the dead leaves beneath, like a shower of rain. These insects pass the winter beneath the dead leaves, and attack the trees as soon as they come into leaf the following spring. Many trees were killed by them some years ago.'

The VANCOUVER ISLAND OAK-LOOPER [*Therina (Ellopia) somnaria*, Huslt].—As stated in my report for 1890, the beautiful oaks on Vancouver Island are periodically stripped, every few years, by hordes of the caterpillars of a geometrid moth. 1904 saw one of these visitations. Mr. J. R. Anderson writes: 'The Oak Looper (*Ellopia somni-*

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aria) appeared in vast numbers in some places on Vancouver Island this year. Strange to say, in certain localities they were entirely absent, but in others they were so numerous that they consumed every particle of their natural food, and they would then attack other trees. In one place, which I was called to inspect, I found that they had attacked even the fruit on apple trees, eating away a layer of the skin and large holes into the interior near the stem. They were also denuding the apple trees of their leaves. There were hundreds on one tree which stood beneath an oak. The larvæ had defoliated the oak tree, then let themselves down in the usual manner, and were on the apple tree in hundreds eating the foliage and fruit. Other trees, as cherry, elm, &c., farther away were also attacked, but not so much as those near the oaks.'

This variation in the food habits of this insect can, I think, only be considered as exceptional. The natural food of the species in Vancouver Island is the picturesque oak, *Quercus jacobi*, R. Br., which grows round the southern end of Vancouver Island. Among the caterpillars forwarded by Mr. Anderson, some parasitized specimens were found, from which was raised a parasite which has been kindly identified by Mr. W. H. Harrington, as *Pimpla Ontario*, Cress. Another parasite, the species usually responsible for the sudden reduction in the numbers of this species, is *Ichneumon cestus*, Cr., a yellowish brown ichneumon fly about three-eighths of an inch long, with one black band across the abdomen, and was found in considerable numbers by Mr. A. W. Hanham, who writes:—

Victoria, B.C., October 25.—The moths of the Oak Looper (*E. somniaria*) have this autumn been a sight to see. Out the Cadboro Bay road large oak trees were covered with the moths a couple of weeks ago, particularly on the underside of the branches and close to the trunks. There were numbers of a reddish brown ichneumon, all of one species, which were flying about the trunks of the trees. I bottled several of these, which I send you.'

The specimens forwarded by Mr. Hanham were *Ichneumon cestus*, Cr.

The WHITE-MARKED TUSSOCK MOTH [*Hemerocampa (Orgyia) leucostigma*, S. & A.]—This common pest of city shade trees, which was referred to at some length in my last report, continues to injure shade trees in some of our cities. The most effective remedies are the collection of the egg masses in winter and the spraying of the trees with arsenical poisons in spring before the caterpillars (Plate II., fig. 9) have grown much and injured the leaves. The Toronto civic authorities are this year taking active measures to clear out the infestation, which for many years has injured the appearance of the beautiful horse chestnut trees for which Toronto is celebrated. A reasonably large sum of money has been voted for the collection and destruction of the eggs during the present winter; and there is every reason to hope that by this means private individuals may be stirred up to do their duty in the public interest by destroying the eggs on their own trees in winter and then spraying the foliage in summer for a year or two.

WALKING STICK INSECT (*Diaperomera femorata*, Say).—A remarkable outbreak of the Walking Stick Insect, which is worthy of record, is reported by Mr. J. B. Williams, of Toronto. This is usually a rather uncommon insect; but Mr. Williams found it in such numbers in the Niagara Glen that thousands might have been collected on oak and butternut trees during September. These trees are ordinary food plants for this curious insect, which belongs to the Phasmidæ, a division of the Orthoptera, the same order as contains the locusts and grasshoppers.

THE APIARY.

The Apiary, as in the past, has been under the management of Mr. John Fixter, the farm foreman, whose report I append herewith. The same experiments which have been carried on for some years have most of them been repeated on account of the large amount of interest which has been evinced in the subject by correspondents and visitors to the Central Experimental Farm. The services of Mr. Fixter have been asked for at a great many meetings of bee-keepers, and, whenever his duties at the Central Experimental Farm would permit of it, he has attended these meetings and given addresses.

REPORT OF MR. JOHN FIXTER.

SEASON OF 1904.

The honey crop in the Experimental Farm Apiary has been a fairly good one, giving an average yield of 63 pounds per colony.

In many parts of the Dominion the honey crop was light, owing chiefly to the very heavy losses of the past winter. Many colonies of bees perished from cold, while they had abundance of stores in their hives. The continued long spells of severe weather prevented them from breaking their clusters to reach their stores. Losses were greater in outside than in inside wintering, although many perished inside, either from insufficiency of stores or from confinement in cool, damp and badly ventilated cellars.

Experiments have shown that bees can be successfully wintered in a good cellar, even if it is damp, providing it is well ventilated. Many colonies died also during the spring after being set out, owing to the cold, backward season.

The number of colonies, which was 35 in the spring, was increased by swarming to a total of 50 when the hives were put into winter quarters on November 23.

Meetings were attended at the following places in Ontario:—Merivale, Metcalfe, Crossland, Phepston, Minesing, Grenfell, New Lowell, Stayner, Elpin, McDonald's Corners, Balderson, Innisville, Drummond Centre, Locust Hill, Markham, Gananoque, Toronto and Barrie; and in the province of Quebec at Shawville, Buckingham and Venosta.

EXPERIMENTS, 1903-1904.

I. CELLAR WINTERING.

Description of the Bee Cellar.—The cellar is below a private house. The walls are of stone and the floor of cement. The bee-room, 11 feet 6 inches wide by 15 feet long and 7 feet high, allows three tiers of shelves and two passages. It is boarded off from the remainder of the cellar by a partition which extends all around the chamber, and far enough from the stone wall to allow of an air space. Should a person have enough bees to fill the cellar the boarding could be left out. Under the cement floor a layer of one foot of stones of different sizes acts as a drain and keeps the cellar perfectly dry. The lowest shelf is 18 inches from the floor, the second 20 inches in the clear above, and the third 20 inches above that. Neither the hives on the third or uppermost shelf nor the uprights supporting the shelves touch the ceiling, so that no vibration can reach the hives from above. This chamber is thoroughly ventilated, as is also the whole cellar.

Before entering the bee room is a smaller compartment with a door leading to the outside and another leading to the bee-room. Both rooms have sliding ventilators in the doors, so that outside air may be let in at will. Ventilation is carefully attended to, and sudden changes of temperature are avoided; for this, a thermometer which is

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always kept in the cellar, is watched. The best temperature for the bee cellar has been found to be from 42 to 48 degrees Fahrenheit. This arrangement has given entire satisfaction. In former years there was not proper ventilation, and the cellar was always damp. Since the concrete floor has been laid and the ventilators have been put in, the cellar has been much drier and cleaner. It is also rat and mouse proof, which is a very great advantage.

Experiment No. 1.—The tops of the hives replaced by chaff cushions and the brood chambers raised at the back.

Six colonies were put into winter quarters in the cellar and placed on the shelves. Under the back end of each hive was placed a three-inch block; each hive was, besides, raised from its bottom board by a one-inch block being placed at the back so as to ensure free ventilation. All front entrances were left wide open; the wooden covers were all removed and replaced with cushions made of chaff 4 inches thick, sufficiently wide and long to lap over the hive two inches. Temperatures were taken once each week all through the winter and were kept very even, from 44 to 48 degrees. The bees were quiet, only a very slight hum being noticeable up to February, when the temperature having risen to 48, the bees began to get uneasy and made considerable hum. Cold air was carefully let in during the night by opening the slides in the doors and closing them in the morning; this, of course, lowered the temperature, and the bees quieted down. During the past winter every colony in this experiment was perfectly dry and clean, and all came out in excellent condition. Average weight of each hive when put into winter quarters, 58½ pounds; when taken out on April 22, 49¼ pounds per hive, showing that each hive had lost 9¼ pounds on an average.

Experiment No. 2.—Tops replaced by chaff cushions and the brood chambers raised in front.

Six colonies were put into the cellar and placed on the shelves, a three-inch block being placed only in front, between the bottom board and the brood-chamber, making the full entrance three inches high across the whole front. The wooden covers were removed and replaced with a chaff cushion. Temperature the same as in Experiment No. 1. During the whole winter all the colonies in this experiment were perfectly dry and clean and showed no uneasiness of any kind. The bees could be seen hanging in a quiet cluster below the frames any time during the winter. The average weight when put into winter quarters on November 23 was 59 pounds 12 oz.; when taken out on April 22, 51 pounds 8 oz., showing that each hive had lost on an average 8 pounds 4 ounces.

Experiment No. 3.—Tops replaced by propolis quilts.

Six colonies were put into the cellar and placed on the shelves, with the bottoms of the hives left on, just as they were brought in from the bee-yard. The wooden covers were removed and nothing left on except a tightly sealed propolis quilt; the natural entrance was left wide open. Temperature of cellar same as in Experiment No. 1. During the entire winter the bees kept perfectly dry, and only a very slight hum could be heard. There were but very few dead bees on the bottom board, and no sign of dysentery. On examination when set on their summer stands all the hives were found to be in first-class condition. The average weight when put into winter quarters November 23 was 59 pounds 15 oz.; when taken out on April 22, 51 pounds 3 oz., showing that on an average each had lost 8 pounds 12 oz.

Experiment No. 4.—Tops and bottoms of hives left on.

Six colonies were put into the cellar and placed on the shelves, with tops and bottom boards of the hives left on, just as they were brought in from the bee-yard.

They were watched for dampness, mould, or dysentery, also to compare the amount of honey consumed. Temperature of cellar the same as in Experiment No. 1. During December and January all were very quiet. During February there was considerable humming. Drops of water were noticed along the entrances of three hives. There were but very few dead bees on the bottom board and no sign of dysentery. On examination when set on their summer stands, two of the hives had considerable moulded combs. The average weight when put into winter quarters, 58 pounds 10 oz.; when taken out on April 22, 49 pounds 3 oz., showing that the average loss of each hive was 9 pounds 7 oz.

II.—WINTERING BEES IN DAMP CELLARS.

Many letters are received inquiring whether a damp cellar is a fit place to winter bees in. An experiment was conducted during the winter of 1902-3, with three colonies of bees. During last winter it was thought advisable to try the same experiment (A) with a larger number of colonies—six—and another (B), also with six colonies with a larger amount of moisture.

In both experiments the six colonies were selected, all of about equal strength, and all in Langstroth hives, weighing on an average 58 pounds each at the beginning of the experiment. The wooden covers were removed from the hives and replaced with propolis quilts; the bottom of each hive was loosened from the brood chamber, and a block two inches square was placed at each corner between the bottom board and the brood chamber, insuring free ventilation from the bottom of each hive. The cellar was kept at a very even temperature of 44 to 48 degrees, and was well ventilated during the whole winter. The six hives in each experiment were resting on the edges of seven pails of water, the full surface of the water being exposed.

A.—The bees could be seen hanging below the frames in a quiet cluster all winter. The hives were all examined once each week, and at no time did there appear to be any sign of uneasiness from the extra moisture. There were scarcely any dead bees on any of the bottom boards nor any sign of dysentery, and all came out in excellent condition. The colonies were set out on their summer stands on March 20; the day being fine and warm, all began to fly at once. The average weight of the six colonies when set on their summer stands was 44½ pounds each. From March 20 to April 5, the weather was cool, and no flying took place up to the latter date, which was a good bright warm day. After this the bees had to remain in their hives until April 22, when the weather became warm again. They then built up rapidly and were in excellent condition for the honey flow.

B.—A second experiment was tried in which the amount of moisture in the atmosphere of the cellar was increased in the following way: Besides the seven pails of water placed on the floor with the six hives resting on the edges of these pails, allowing the full surface of the water to be exposed, six inches of sand was spread on the cellar floor between the pails and covering six inches of the floor outside of the pails. There was also a large cotton sheet spread over the six hives. The sand and sheet were kept thoroughly saturated with water which was poured on them once each week during the winter.

The bees in this test were more uneasy than in the experiment first described where no sand or cotton covering was used, having to keep up fanning for ventilation. There were also a great many more dead bees on the bottom boards and several hives had drops of water along the entrance, but there was no sign of dysentery. On March 20, the day being fine, the colonies were removed to the bee-yard, where all began flying at once. The average weight of the six colonies when set on their summer stands, was 44½ pounds each. From March 20 to April 22 the bees had but one good flight. After April 22 the weather became considerably warmer; the colonies began building up rapidly, and were in excellent condition for the clover bloom.

The average strength of the six colonies that had the extra moisture was not as great as in the former test, but as soon as they got fine weather they gained rapidly.

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Care was taken that the colonies in both tests had plenty of unsealed stores before fruit bloom and between fruit and clover bloom. This was done by uncapping one side of a frame of honey nearest to the cluster, allowing the bees to use up the honey for food and providing space for the queen to lay her eggs. Although so much moisture was in close proximity to the colonies, a great deal of the success of this experiment is no doubt due to the good cellar in which it was tried, the cellar having stone walls, cement floors, good ventilation and the temperature being easily regulated. This goes to show that good ventilation and even temperature have a great deal to do with successful wintering. An excellent plan for ventilating is to have sliding ventilators in the doors, so that much or little air may be let in as desired. Also connect an extra stove pipe, provided with a damper, to the regular heating stove. This may be done by means of a T, or an extra flue will answer. Allow the pipe to extend into the cellar. This plan of ventilating has proved very successful.

III.—INSULATING HIVES FOR OUTSIDE WINTERING.

For this experiment, the hives were insulated against the winter cold by air cushions in the following manner. Slats 1 inch thick were nailed at intervals all around the hive, on these was tacked one layer of thick brown building paper and then a layer of oiled paper, which increases durability and also keeps out vermin. In order to provide extra protection to the hive, a box six inches wider and six inches longer was placed over this with an opening cut at the entrance, 1 inch by 2 inches, all other openings being closed. The wooden covers of each hive were removed and replaced with a chaff cushion 3 inches thick, the latter placed on the propolis quilt, and lapping over the sides of the hive; two layers of paper were then put on top of the cushion and a second cushion added, which had the top of the outside box over it. This experiment, first tried during the winter of 1902-3 with two hives, was repeated last winter for the second time with four colonies in Langstroth hives. These were all four placed in a large packing case, one foot larger each way than the hives, which were six inches apart in the case, with six inches of cut straw on the bottom of the case for the hives to rest upon. The six-inch space between the hives was packed with cut straw, as well as the one-foot space all around and on top of the hives. The entrances of two of the hives faced each other, and two hives faced west. The entrance to the hives was kept clear of snow all winter to ensure free ventilation. The hives were in a corner well sheltered from cold winds.

No sound could be heard from these colonies all winter. On March 22 the bees made their appearance, many flying briskly, going out and returning. From March 22 to April 22 the bees had but one good flight. On April 22 they were then examined. Very few dead bees were found on the bottom boards; the combs were dry and clean and there were no signs of dysentery. The hives were then removed from the packing case and placed on their summer stands. The average weight of the hives when put into winter quarters was 62½ pounds; when put on their summer stands, 49½ pounds, showing that each hive had lost 13 pounds 4 ounces. The weather after this date (April 22) being bright and warm, the bees built up rapidly and were in excellent condition for the honey flow.

IV.—EXPERIMENTS TO DETERMINE WHICH BEES WOULD CONSUME MOST OF, HONEY OR SUGAR, WHILE CONFINED IN THEIR WINTER QUARTERS.

Eight colonies in Langstroth hives were selected for this experiment, all of as nearly equal strength as could be secured. On September 1 their natural stores were removed from both sets. On September 2 all were weighed as follows:—

(a.) The four colonies fed sugar syrup: No. 1 weighed 30 lbs. 7 oz.; No. 2, 31 lbs. 12 oz.; No. 3, 31 lbs. 10 oz.; No. 4, 31 lbs. 3 oz.; average of weight, 31 lbs. 4 oz.

(b.) The four colonies fed extracted honey: No. 1, weight, 30 lbs. 9 oz.; No. 2, 31 lbs. 10 oz.; No. 3, 30 lbs. 12 oz.; No. 4, 31 lbs. 1 oz.; or an average of 31 pounds.

Miller feeders were placed in empty section supers, close to the top of the brood frames, any part of the brood frames not covered by the feeder being covered by a propolis quilt cut so as to allow the bees a passage through it. By keeping the feeder well packed around, except where the bees enter, the heat is kept in and at the same time the bees cannot daub themselves with the liquid. In both experiments the bees had a constant supply of syrup and honey. Both the honey and the syrup were supplied to the bees at about blood heat. The syrup was made of the best granulated sugar, two parts to one of water by weight. The water was first brought to a boil, then the boiler was set back on the stove and the sugar having been poured in, the mixture was stirred until all was dissolved.

The four colonies fed sugar syrup when put into winter quarters November 24, weighed as follows:—

No. 1, 61 lbs. 4 oz.; No. 2, 62 lbs. 9 oz.; No. 3, 62 lbs. 7 oz.; No. 4, 62 lbs.; or an average of 62 lbs. 1 oz. each.

The four colonies fed extracted honey when put into winter quarters on November 24, weighed as follows:—

No. 1, 62 lbs. 13 oz.; No. 2, 62 lbs. 14 oz.; No. 3, 62 lbs.; No. 4, 62 lbs. 5 oz.; or an average of 62 lbs. 8 oz. each.

The four colonies fed sugar syrup when taken from their winter quarters March 22, weighed as follows:—

No. 1, 47 lbs. 3 oz.; No. 2, 49 lbs. 4 oz.; No. 3, 51 lbs. 5 oz.; No. 4, 51 lbs. 8 oz.; average, 49 lbs. 13 oz.

The four colonies fed extracted honey when taken from their winter quarters March 22, weighed as follows:—

No. 1, 50 lbs. 9 oz.; No. 2, 53 lbs. 1 oz.; No. 3, 51 lbs. 12 oz.; No. 4, 51 lbs. 2 oz.; average, 51 lbs. 10 oz. Difference in favour of the honey feeding, 1 lb. 13 ounces per colony.

When the hives were put into winter quarters and placed on the shelves in the cellar, the wooden covers were raised at one end $\frac{1}{2}$ an inch, while the sealed propolis quilt was left undisturbed. The hives were all given extra ventilation at the bottom by placing at the entrance a wooden block between the bottom board and the brood chamber, thus raising the front of the brood chamber 3 inches extra. During the balance of November and December very slight humming could be heard; during January and February scarcely any appreciable hum could be heard. During the whole winter there was no sign of uneasiness of any kind, and very few dead bees were found about the entrance; the bottom boards were quite clean and there was no sign of dysentery in either experiment. All came out in first-class condition and built up rapidly for the honey flow.

V.—EXPERIMENT WITH QUEEN EXCLUDERS IN HIVES FOR THE PRODUCTION OF EXTRACTED HONEY.

Eight colonies were taken for this test—4 in Langstroth hives, 4 in Heddon hives.

Two colonies in each case had queen excluders between the brood chamber and the extracting frames; thus, every pound of honey secured was pure.

The two remaining colonies in each set had no queen excluders. The queen in every instance went up into the extracting frames where eggs were laid and young brood raised. This latter plan is practised by too many who call themselves bee-keepers. It is impossible to extract honey from frames where brood is present without throwing out the young larvæ at the same time. There are also many who do not use any surplus cases, especially those who use the old box hive. They take their honey out of the brood chamber after smoking or killing the bees. This

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practice is to be strongly condemned, as the honey taken out of a brood chamber, or out of extracting frames where brood is present is not fit for human food.

On November 8, all colonies were weighed and found to be in good condition. They were then put into their winter quarters.

INTRODUCING QUEENS.

Eight queens have been introduced during the season, four on the Benton plan and four with frames of brood taken from several hives. All queens belonging to the colonies that were to receive the imported queens, were removed 24 hours before introducing the new queens.

ONE METHOD—'BENTON INTRODUCING CAGE.'

The Benton mailing and introducing cage is ordinarily used in this country. It consists of an oblong block of wood with three holes bored nearly through, one of the end holes being filled with good candy, and the other two being left for the occupancy of the bees and queen. On the back of the cover are printed directions for introducing a new queen into a hive, and at each end of the cage is a small hole bored through the end of the block of wood, but which in the mails is stopped by a cork. One hole is for the admission of the bees and queen preparatory to mailing, and the other for the liberation of the queen, by the bees eating out the candy in the course of 20 to 30 hours, thus releasing her in a natural way. When the cage is received, the cork covering the candy is to be removed, as well as the wooden cover over the wire cloth. The cage is then carefully placed on top of the frames, so that the wire cloth be over the space between two frames in the centre of the brood-nest. The queen will then be released by the bees in the manner explained.

I would advise all to have extra cages for introducing, so that no disease may be brought in with the queen. See that the cage you introduce with is thoroughly cleaned, and have fresh food made from your own honey placed in the cage in readiness. Then remove the queen and bees from the cage they were received in, to the one prepared for them and follow the above directions.

How to Make Honey and Sugar Thick for Feeding.

Take good thick honey and heat (not boil) it until it becomes very thin, and then stir pulverized sugar into it. After stirring in all the sugar the honey will absorb, take the mixture out of the vessel, and thoroughly knead it with the hands. The kneading will make it more pliable and soft, so that it will absorb or take up more sugar. For summer use it should be worked, while mixing in a little more sugar, until the dough is so stiff as to be hard to work; it should then be allowed to stand for a day or two; and, if still so soft as to run, a little more sugar should be kneaded in. A good deal will depend upon the season of the year; there should be more sugar in proportion to the honey in warm weather than in cool weather.

ANOTHER METHOD OF INTRODUCING QUEENS.

Select a strong colony, remove the wooden cover of the hive, and place a fine wire netting over the tops of the brood frames to shut in the bees; place on top of this wire cloth a brood chamber with four frames of well sealed brood, selected from different hives, with young bees just hatching out, but with no unsealed brood. Put the queen in this brood chamber, which should then be closed bee-tight, and kept over the strong colony four or five days. By that time a respectable force of young workers will have hatched; the hive may now be placed on the stand where it is to remain, the entrance being made large enough for only one bee to pass at a time, as a precaution against robbing. The entrance may be widened as the colony gets stronger. This latter plan has never failed with me.

JOHN FIXTER.

DIVISION OF BOTANY.

THE RUSTS OF GRAIN CROPS.

The losses from the attacks of different kinds of rusts on the cereal crops of the Dominion during 1904, were considerable, and have been reported from every part of the Dominion. In Manitoba and the North-west Territories rust on grain is very seldom heard of; but during the past autumn just about the time the grain was ripening the climatic conditions were such that rust developed to an alarming extent. The parasites which cause this disease are always present to a certain degree on grain crops as well as on several kinds of the wild prairie grasses, and this year they spread on the grain crops and were the cause in some places of great loss to farmers. There was so much interest created among settlers in the West that I was requested to prepare an article upon the subject for the Montreal *Family Herald and Weekly Star*, which was published in the issue of November 30 last. As it is of general interest and a great many inquiries have been made for a popular description of the disease and its cause, I reproduce the article herewith.

THE RUST OF WHEAT.

The subject of the rusts of grain crops is of special interest just now, owing to the unusual epidemic of these destructive parasites in the large wheat fields of parts of Manitoba and the eastern North-west Territories during the past season.

The loss from this cause was undoubtedly considerable; but there was no such wholesale or widespread destruction of the wheat crop in the prairie provinces, as was described in some United States and English newspapers. I have had opportunities of examining samples of rusted straw from many localities, which have been kindly sent in by Mr. David Horn, Chief Inspector of Grain, at Winnipeg, by the agricultural papers and by several correspondents. As a report on the whole of these samples, it may be said that, although some were seriously affected by rust, not one of them was as badly rusted as crops are frequently found to be in eastern Canada, which are nevertheless thought to be worth cutting for grain.

In passing through the Territories and Manitoba in the second week of August, although the crop was rather late and green, I saw no appearance of rust, nor did I hear any complaints of its occurrence at that time. The first reports were received about the 20th August. Early in September several items in the newspapers showed that there was much anxiety as to the extent of the loss which might occur. The localities where most harm was done, were in the Red River valley, in south-western Manitoba and in eastern Assiniboia. In the Regina district a few crops are said to have been so badly rusted that they were burned. The rust in these fields appears to have been noticed on the leaves and heads about the middle of August. On the 18th of that month there was a hailstorm, accompanied by rain; and immediately afterwards the rust spread rapidly.

In Manitoba, for fear of further injury, some crops of wheat were cut too green to be of use for grain, or were made into hay. Under the circumstances, and, as the season turned out, this was a wise course; for it has been found by Mr. Shutt, the Chemist of the Experimental Farms, that straw attacked by rust makes far better feed for stock even than clean straw, because the presence of the parasite causes the retention in the straw of the nutritious principles which after the seeds are formed are transferred from the straw into the grain.

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THE EFFECT UPON THE WHEAT PLANT.

The physiological effect upon the wheat plant by the presence of the rust parasite is better understood by a consideration of the life history of the minute plants which are known as rusts. The term Rust, as applied to cereals, describes a disease due to the attacks of several different parasitic fungi belonging to the Uredineae, a family which includes the most destructive parasites of cultivated and wild plants; and it must not be forgotten that rust is a plant, and, although so minute that a strong microscope is required to examine it, it is just as much a true plant with a definite life history of its own, as the wheat, oats, grasses, &c., upon which it grows.

The general belief that rust comes with rain, fog, or heavy dew after a hot day, is in the main correct; but the moisture and hot air are not actually the cause of the trouble; they merely act as the carriers of it and provide the conditions necessary for its injurious propagation.

The rust which was answerable for nearly all the injury in the West last season, was the Black Stem Rust. There are about a dozen different kinds of rusts which occur on wheat, oats and barley in this country. The commonest of these are the Orange Leaf Rust (*Puccinia rubigo-vera*) or Spring Rust, and the Black Stem Rust (*Puccinia graminis*), or Summer Rust, which attack all kinds of small grains, and the Crown Rust, or Orange Leaf Rust, of oats (*Puccinia coronata*), which does not occur on wheat or barley. Each of the first two named species has distinct specialized forms which attack wheat, oats and barley and some other grasses, but which very seldom infest plants belonging to other grains than those upon which they developed. For instance, spores of the Black Stem Rust of wheat will not produce readily on either barley or oats the corresponding rusts of those plants and *vice versa*. The two common rusts of wheat occur in all parts of the world, where that staple crop is grown; and in almost every instance it has been found that the Black Stem Rust is by far the more injurious of the two. The Orange Leaf Rust appears earlier in the season and is the more conspicuous; but the later-developed Black Stem Rust attacks its host in a much more vulnerable spot, namely on the stem, the channel up which the nutritious principles are carried from the vegetative system of the plant to be stored up in the seed. Developing on the stem, it arrests and feeds upon these important elements, thus causing starved and shrunken grain. The Orange Leaf Rust of oats is a different species from the Orange Leaf Rusts that occur on the other small grains; and like them has a red rust or spring form and a dark-coloured or summer form; but the Black Stem Rust of oats is merely a specialized form of the species (*Puccinia graminis*), which is also found on wheat, barley and rye, as well as on many different kinds of grasses.

THE GROWTH OF THE PARASITE.

In the case of the Black Stem Rust, the growth of the parasite is the same, whatever its host plant may be. It passes the winter in a resting condition on the old stems of the previous year. In the fields this will be chiefly on the stubble. The winter-spores or seed-bodies germinate early in spring and produce another kind of spores, which are exceedingly light, and are borne from place to place by the faintest breath of wind. These, alighting on the growing grain plants, produce, later, what is known as the red-rust or uredo stage of the fungus, to be followed in autumn by the resting winter-spores of Black Stem Rust. The sequence of this development is as follows: As soon as the minute spores of the first germination are carried on to a leaf of a growing plant, they germinate and throw out very slender tubes, which enter the tissues of the host plant in the same way that roots penetrate the soil. Here they feed at the expense of their host, and in time produce large numbers of reddish brown spores, which burst through the tissues and cause the red-rust stage, which again, later on in the season, is followed by the black-rust stage, which consists of the pro-

fuse production of another kind of spores, brownish black in colour. These are the teleutospores, and are the means of carrying the parasite over the winter. These black winter-spores frequently appear in this species in the same spots on the stem, where the red-rust stage was earlier in the season, but do not germinate until the following spring.

RUST AND THE BARBERRY.

In addition to these two forms of the Black Stem Rust, there is another stage which has been the subject of much controversy. This comes from the spores of the first generation in spring falling upon the leaves of some species of barberry, where they give rise to a curious fungus, known as Barberry Cluster-cup. After a time this matures and pours out enormous numbers of spores which are carried in all directions by the air and fall upon grain plants, where they give rise to Red Rust. Strange to say, this remarkable fact in the life history of rust was discovered very many years ago, and laws looking to the extermination of the barberry plant date back to 1660, when an Act having this object in view was passed in France.

It is not, however, absolutely necessary for Rust to have its first stage on the barberry, although experiments have shown beyond doubt that it does sometimes occur on that plant. The theory has been advanced that growing in this way in one of its stages on the barberry gives the parasite greater vigour; but it is beyond question that the Black Stem Rust can continue to grow in localities where no barberries are grown, and it is also known to occur in specialized forms on many of the wild prairie grasses. Among the samples of grasses sent to me from Manitoba with the rusted wheat, were specimens of the Skunk-tail grass, or Squirrel-tail (*Hordeum jubatum*), which bore well developed pustules of Black Stem Rust, similar to those which occur on wheat and cultivated barley. The Skunk-tail grass is a very bad weed of the West, and certainly increases in hay lands, owing to a habit farmers have of leaving this grass uncut when mowing, so that it ripens and distributes its seeds. If it were cut down at the same time as hay, the unripe seeds would soon dry up, or might be easily burnt after the hay was carried. Mr. Mark A. Carleton, Cerealist of the United States Bureau of Plant Industry, who has made extensive investigations of rusts, writes as follows:—

‘It is positive now from experiments made by this department that the Rust of *Hordeum jubatum* will easily transfer to wheat and barley, and therefore it would decrease the chance of infection of a wheat field, if this grass could be kept out of the wheat, or if the wheat were sown away from its influence.’

REMEDIES.

Little can be done as a remedy against rusts; but, as the parasite passes the winter on the old straw, land left for seeding on stubble should be burnt over carefully before seeding, and the ploughing down of stubbles for summer-fallow should be done as early as possible in the season, so as to prevent as much as may be the distribution of the first generation of spores. Rusted straw fed to cattle is said to distribute the fungus in grain crops from the spores being carried through with the manure. Fresh manure, therefore, should not be used in fields where grain is to be grown. The investigations which have been carried on in Australia, have run largely towards the discovery of varieties of grain which may be more or less exempt from the attacks of rust. Although probably no variety has yet been found entirely free from these parasites, still much has been learned as to the comparative immunity of some kinds, and Mr. Carleton points out that the investigations are said incidentally to have resulted in Australia now having varieties of wheat which are vigorous, true to name, and of exceptional quality for the particular region in which they are grown.

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Ever since the institution of the Experimental Farms, much attention has been paid in our experiments with cereals to the problem of rust-resistance. Seed grain has been obtained from all parts of the world. The Australian and many other varieties said to be of special quality have been secured and experimented with, with a view to ascertaining the rust-resisting power of each. A vast amount of useful information will be found by looking through the annual reports of the Experimental Farms, where in the tables of yields of varieties, a special column is devoted each year to the amount of injury by rust on every variety of wheat and oats grown at the different Branch Farms. The result of these experiments, as stated above, is that no variety of wheat or oats, so far, has been found which is perfectly free from rust, although by constant selection those varieties are being separated, which have the greatest power to resist the attack of the parasites.

It may be mentioned here that up to the present time experiments in spraying grain fields with Bordeaux mixture and other fungicides for the prevention of rust have not been attended with any success.

ENCOURAGING FEATURES.

There are some features of the rust epidemic of 1904 which may well be borne in mind by western farmers.

1. The extent of injury this year was much influenced by the unusual season, owing to which all crops were later than usual. The spring was late, cool and dry, followed by hot weather, which suddenly changed at harvest time to dull, wet weather of long duration. The result of these conditions was that, at the time when wheat and oats should have been ready to cut, which was the exact time when the rust appeared this year, not only were grain crops in an exceptionally late and succulent state, but the atmospheric conditions, which were very unusual for the region, were just such as would allow of the rapid development of parasitic fungi.

2. Such an extensive outbreak of rust is without any precedent in the history of the Canadian West.

3. As in ordinary seasons rust has been almost unknown in the West, such extensive injury as was experienced in 1904, must be considered as exceptional and not likely to occur again for many years.

J. FLETCHER.

PERMANENT PASTURES.

The following table gives the yields from the permanent pasture experimental plots for the past four years:—

Number.	SEED SOWN PER ACRE.		CURED HAY, PER ACRE.					
	Mixtures Nos. 1-17, sown May 4, 1901. Sainfoin, No. 18, sown May 1, 1903.		1904.		Total.			
	Grasses.	Clovers.	June 24.	August 12.	1904.	1903.	1902.	
	Lbs.	Lbs.	Tons. Lbs.	Tons. Lbs.	Tons. Lbs.	Tons. Lbs.	Tons. Lbs.	
1	Timothy..... 6 Meadow Fescue.... 4 Orchard Grass.... 2 Kentucky Blue.... 1 Red Top..... 1	Alfalfa..... 2 Alsike..... 2 Mammoth Red... 1 Common Red..... 1 White Dutch..... 2	3 880	2 3	5 883	4 520	4 40	
2	Meadow Fescue.... 6 Timothy..... 3 Canadian Blue.... 2 Orchard Grass.... 3 Red Top..... 3	Alfalfa..... 4 Alsike..... 1 White Dutch..... 1	3 960	2 101	5 1,061	3 1,566	4 660	
3	Timothy..... 5 Awnless Brome.... 4 Orchard Grass.... 2	Alfalfa..... 6 Alsike..... 3	3 1,021	1 1,320	5 341	4 770	5 120	
4	Meadow Fescue.... 6 Orchard Grass.... 2 Kentucky Blue.... 1	Common Red.... 4 Alfalfa..... 3 White Dutch..... 1	3 1,079	1 1,381	5 460	4 320	5 1,520	
5	Timothy..... 6 Upright Brome.... 4	Alfalfa..... 6 Mammoth Red.... 4	3 1,282	1 1,339	5 621	4 840	4 960	
6	Timothy..... 10	Common Red... 6	3 880	1 840	4 1,720	2 880	4 760	
7	Timothy..... 10	Mammoth Red... 6	3 120	1 520	4 640	1 1,520	3 1,200	
8	Orchard Grass.... 18	Alsike..... 5	1 1,680	1,892	2 1,572	2 80	2 1,200	
9	Orchard Grass.... 18	Common Red... 8	2 360	1 160	3 520	2 1,600	3 1,280	
10	Meadow Fescue.... 20	Common Red.... 8	2 240	1,997	3 237	2 680	3 40	
11	Timothy..... 12	Mammoth Red.... 8	2 1,980	1,912	3 1,922	2 1,400	3 1,760	
12	Timothy... .. 12	Common Red... 8	3 320	1 70	4 390	2 1,920	3 20	
13	Timothy..... 5 Awnless Brome.... 10	Common Red... 5 Mammoth Red.... 5	2 1,840	1 1,240	3 1,030	2 1,840	4 300	
14	Awnless Brome.... 25	1 1,881	840	2 721	1 1,360	3 1,020	
15	Awnless Brome... 15	Common Red.... 8	2 1,889	1 320	4 209	3 360	4 760	
16	Timothy..... 8	Mammoth Red... 8	3 1,652	1 129	4 1,781	3 1,160	3 340	
17	Sainfoin..... 40	3 1,998	2 1,400	6 1,398	4 1,160	3 1,160	
18	Alfalfa..... 15	2 840	1 837	3 1,677			



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