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FROM ANNUAL REPORT ON EXPERIMENTAL FARMS FOR THE YEAR 1903

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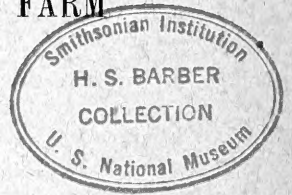
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CANADA

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DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM



REPORT OF THE ENTOMOLOGIST AND BOTANIST

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

1903

OTTAWA  
GOVERNMENT PRINTING BUREAU  
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# REPORT

## OF THE

# ENTOMOLOGIST AND BOTANIST

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

1903.

OTTAWA, December 1, 1903.

Dr. WM. SAUNDERS,  
Director of Dominion Experimental Farms,  
Ottawa.

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

The appreciation of the value of the investigations prosecuted by the officers of the Division is indicated by the large correspondence with farmers, fruit-growers and others in all parts of Canada. It is impossible in an annual report to deal with all the subjects which come up for consideration during the year. Many of these have already been treated of in previous reports, and the investigation of some is as yet in an incomplete state. Correspondents are constantly adding much to previously recorded facts concerning the habits of injurious insects, the utility of remedies, and the best way to apply them, the value of fodder crops, and many other subjects. The correspondence and replies relating to these are all carefully preserved and classified for future use. A complete index has been made of all letters which have been sent out from the division since the institution of the Experimental Farms up to the present time, which is of much use when working up afresh a subject which has been previously studied.

*Fodder Plants.*—The testing of grasses and other fodder plants, native and exotic, both in the experimental grass plots at the Central Experimental Farm and by correspondents, has been continued, and, as in the past, has been a source of much interest to all who have witnessed these experiments. The Awnless Brome Grass, the cultivation of which, from its introduction up to the present time, I have persistently endeavoured to encourage, has proved a great boon to farmers and stockmen in Manitoba and the North-west Territories. This grass is now recognized as one of the important staple crops of the West, where it is grown both for hay and pasture, as well as for the seed, which always meets with a ready sale. Attention has also been drawn to the value of various mixed crops for summer feed, and, following the experience of our Superintendents at the western farms, some farmers have grown with great satisfaction mixtures of pease, oats and wheat, one bushel of each to the acre; tares and oats, or pease and oats, one and a half bushels of each to the acre.

Lucerne or alfalfa has been tried to a certain extent in most of the provinces of the Dominion, and where care has been taken to prepare the land properly by ploughing deeply and then consolidating and smoothing the surface by harrowing, it has done

well in many localities where it had been thought previously that this most valuable clover would not grow. It is also most important that the land should be in the condition known by farmers as 'good heart,' that is, fit to grow a good crop of an ordinary farm crop. I feel confident that this fodder plant, which is of such immense importance in the semi-arid districts of the western States, both on ordinary farm land and under irrigation, is worthy of a much more extensive trial in the North-west and Manitoba than up to the present it has received. This, to a large measure, is also the case with the other well known clovers so extensively cultivated in the East, but which are considered out of the question as farm crops on prairie farms. All of these clovers may be found in many places along railway banks throughout the West, and, where they have been tried on farms, although the general result has been considered a failure, still there are many plants persisting and in some places increasing slowly year by year. It is now well known that the satisfactory cultivation of clovers is much affected by the presence of bacteria-containing nodules upon the roots, and that, if these be present in the soil, the vigour of the plant is much increased. This increase takes place more and more every year when clovers are grown upon new soil, the original bacteria, adjusting themselves to the clovers from nodules on roots of native leguminous plants, or, possibly, being carried with the seed. White Clover is thoroughly established in the streets of Winnipeg and some other Manitoban towns, where it is sown to crowd out coarse weeds along the boulevards and in the streets. This plant grows well also at Regina, Calgary, and many other places. Mr. Bedford, the superintendent of the Manitoba Experimental Farm, writes:—'On this farm, when sown without a nurse crop, Alfalfa, Common Red, Mammoth Red, Alsike and White Dutch Clovers form robust plants by fall, and do not fail to pass the winter successfully. I sow in spring without a grain crop, because, when sown with grain, alfalfa and other clovers, but particularly alfalfa, have been winter-killed, the roots produced during the first year being small and short. I have grown alfalfa since 1887.'

When travelling through the North-west Territories, I have frequently come across farmers who have small patches of alfalfa, some of these of three or four years' standing, and Mr. T. N. Willing, of Regina, who, as Provincial Weed Inspector, has exceptional opportunities of seeing what crops are grown on farms in all parts of the North-west Territories, and who, as a practical farmer, is well able to judge the value of crops, writes:—'I am sorry to say I am not aware of any one who is conspicuously successful with alfalfa on a large scale, although many have tried small patches, which have apparently given most promising results. Mr. W. Stevens, of Cloverbar, near Edmonton, has a patch in its second season, which wintered perfectly; when mowed at the end of July it was between three and four feet high and gave a crop estimated at from three to three and a half tons. Near Battleford, the late Mr. Laurie sowed alfalfa about 1884; the season was dry, but the plants struggled on in spite of drought and gophers; the farm was subsequently abandoned, but in 1900, the alfalfa area was still clearly defined and proved attractive to the cattle. Mr. Laurie was satisfied that this would have done well, had he been able to care for it better. A man near Boscurvis has grown alfalfa for three years, and it has constantly improved. Near Prince Albert it was grown for five years by Mr. Acorn, but was then killed out by a late spring frost.'

In view of what I myself have seen in the North-west, and of statements made by farmers who have tried it upon small areas, I have thought it wise to recommend farmers in the West to test alfalfa more thoroughly, doing so on small areas and sowing in spring at the rate of from fifteen to twenty pounds to the acre, without any nurse crop and upon land which had been summer-fallowed the year before. The first year all that would be necessary, would be to mow the weeds. If, in districts where there is a little more moisture than is found on the open prairies, it was thought desirable to mix with the alfalfa or clover any grass, decidedly the best kinds for this purpose would be the Awnless Brome or the Western Rye-grass, which might be mixed in the proportion of ten pounds of alfalfa to six pounds of the grass seed. Awnless Brome does

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not as a rule make a very heavy growth the first season, and therefore it would not crowd out the somewhat delicate alfalfa seedlings, nor deprive them of too much soil moisture. The alfalfa, being a very deep-rooted plant, would be well suited for cultivation with either of these grasses, the root systems of which are much nearer the surface. I am glad to learn that the North-west government has secured from the Russian government a quantity of seed of the Turkestan variety of alfalfa, which will probably be distributed for testing in various localities next spring. This variety is merely a form of the common alfalfa which has been grown in Western Asia for a long time and has thus become accustomed to more severe conditions. I was fortunate enough to secure from the United States Bureau of Plant Industry some seed of the original distribution which was brought to America, and have a vigorous plot now growing from that seed. The two plants are almost indistinguishable, although the Turkestan variety is rather more vigorous in growth; but the leaves and flowers of both forms are similar.

*Collections.*—The collections of insects and plants in the Division have been very much augmented during the past year, many interesting additions having been made from material collected in the field, as well as through the kindness of correspondents who have sent in collections to be named by the officers of the Division. The success of the recent Nature Study movement in education has had a marked effect in increasing the interest in the subjects dealt with in the Division of Entomology and Botany, as has been evidenced by the large number of natural history objects which have been sent in with inquiries for information concerning them. These were for the most part insects and plants and came from teachers, students and farm children living in every province of the Dominion. I was much pleased to have the opportunity of distributing useful knowledge concerning these important subjects in this direct way to those for whom it was of so much practical value; and, moreover, from this source many valuable additions have been made to all of our collections. For several years material of all kinds has been accumulating from my own collections in the West, from the extensive breeding investigations into the life-histories of insects which have been carried on here, and from specimens sent in by correspondents for examination. During the past season many insects have been mounted and arranged in the cases, as well as plants in the herbarium, so that we have in the Division fairly good working collections which are now available for reference when required.

*Insects.*—The chief effort has been made to study and represent in the cabinets the various stages of those species which are injurious to crops, and those which are known to be beneficial. Much has also been done to build up the general scientific collections of the different natural orders of insects.

*Plants.*—Large additions have been made to the collection of native wild plants, and some hundreds of sheets have been mounted and arranged in the herbarium. These consisted chiefly of plants of various orders from the North-west Territories, from the Rocky Mountains, and from British Columbia. A good representation has also been secured of fodder plants, particularly of grasses. Agricultural weeds and poisonous plants, which are a subject of burning interest in the wheat lands of the West, and on the stock ranges, are well represented in our collections, and a recent improvement has been made by arranging the collection of seeds of weeds and other plants; this collection now contains seeds of about 450 species and includes nearly all of the weeds of importance in different parts of the Dominion. These samples have been of much service in identifying seeds found among seed grain and clover and grass seeds, sent in by farmers and seed merchants for examination as to purity and for testing as to vitality.

*Insects of the year.*—I am pleased to report that there have been no serious outbreaks of injurious insects during the season of 1903, nor have any new pests of importance made their appearance. One species of interest, but of no great economic im-

portance is the Rhubarb Weevil (*Lixus concavus*, Say), which was found injuring rhubarb at Harrietsville, Ont. There was, however, been considerable loss in various parts of the Dominion from regularly occurring insect enemies; and, where farmers have applied promptly the remedies recommended, great saving has been effected. The season, on the whole, has not been quite as propitious as usual for good crops. Until the middle of June, the exceptional drought which prevailed through eastern Canada, prevented the germination of seed of all kinds, which retarded the development of many crops and exposed them to attacks from insect enemies. Later in the year, cool damp weather prevailed, which again delayed maturity and was the cause of some loss. Some of the leading features of insect presence during the year were the following:—

Among cereal crops there were no widespread or very serious losses. Hessian Fly was reported as the cause of some loss in Prince Edward Island, at one place in western Ontario and in restricted localities in Manitoba and the North-west Territories. The Wheat-stem Sawfly was abundant and destructive, although little observed, in south-western Manitoba. The Grain Aphis appeared suddenly during July and August in enormous numbers throughout Ontario, in Manitoba and in the North-west Territories and was the cause of considerable alarm; happily, however, the parasites which usually control this species, appeared soon afterwards and eventually, owing to the excellent weather for the grain to fill which prevailed last autumn, the injury was unimportant. In Manitoba locusts did some harm, but this was far less than in previous years. Farmers throughout the district, assisted by the provincial government, applied the standard remedy, the Criddle mixture, and in every instance with most satisfactory results. Experiments undertaken with a view to destroying these insects in a wholesale manner with the fungous disease which has been used in other parts of the world, were without avail, and this, I find, has been the general outcome of most experiments of this nature. Occasional successes which have been reported, seem to have been largely due to exceptionally advantageous atmospheric conditions at the time of the experiments. An outbreak which caused widespread alarm in Manitoba, was by the caterpillars of two broods of a common prairie moth, which this year appeared in vast numbers and, having consumed all of their natural food plant, the common weed known as Lamb's Quarters, ate many other plants, amongst which were some kinds of garden plants. This insect was the pyralid known as the Sugar-beet Web-worm (*Loxostege sticticalis*, Linn.).

Root crops and vegetables were diminished to a certain extent by the ordinary pests of the field and garden. Cutworms of various kinds were reported during the dry spring weather from all parts of the Dominion, and where not controlled did much damage. Root maggots, as usual, were irregular in their appearance, but in most places were the cause of great loss amongst onions, radishes, cabbages and turnips. The Colorado Potato Beetle was noticeably less abundant in most places. The Asparagus Beetle, a recent importation into Canada, although not a cause of much loss, has gradually extended its field of destructiveness, and last summer was reported as far east as Toronto.

Fruit crops generally have been good and remunerative, growers in all districts are seeing more and more the advantage of practising such common sense factors of success as spraying for the prevention of insect enemies and fungous diseases. The San Jose Scale has been held in check to a satisfactory extent wherever instructions of specialists have been followed, and although this insect has not spread beyond the limits of the previous year's infestation, the injury done and the future danger from it work are very great. The work of the Oyster-shell Bark-louse has been much complained of in New Brunswick, Nova Scotia and Ontario. The Pear-tree Flea-louse has been locally in Ontario the cause of considerable loss and has for the first time this year been recorded from Nova Scotia. The Pear-leaf Blister-mite is abundant in British Columbia and occurs now in every province of the Dominion. When trees have been sprayed just before the buds burst, with the lime, sulphur and salt wash, good results have followed. Plant-lice of various kinds were rather more abundant than

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usual on apple, plum and cherry trees, but were in most cases destroyed by parasites before much damage was done. The Tent Caterpillars, Cankerworms and the Codling Moth were noticeably less troublesome last season than for some years.

Shade-tree and forest insects were seldom referred to in correspondence, and few serious attacks were observed. In Montreal, Kingston and Toronto the White-spotted Tussock Moth has increased so much that remedial measures are now urgently needed or the beauty of shade trees in these cities will be much marred at no distant date. A remarkable outbreak of the Maple Soft Scale, *Pulvinaria innumerabilis*, Rathvon, took place on the street shade-trees last summer in London, Ont., causing much inconvenience to foot passengers, and the same insect also occurred on the shade-trees in Woodstock, Hamilton, and some other towns in western Ontario. The Negundo Plant-louse disfigured shade-trees to some extent in Winnipeg, Regina and Calgary, but not to a very serious extent. An insect which has gradually increased in abundance and now is destructive over a wide area in Canada, is the Spruce Gall-louse represented in the East by *Chermes abietis*, L., and in the West by *Chermes sibirica*, Cholodk. On small ornamental trees, spraying with a tobacco and soap wash has been effective, but in forests nothing can be done to check the ravages. There are, however, indications in some places that good work is being done by parasites. The unsightly nests of the Fall Webworm have become conspicuously more abundant lately than they have been for several years, and already demand attention from municipal authorities in towns, as well as from fruit-growers in many parts of Ontario and Quebec as also in British Columbia. The insect occurs right across the Dominion.

*Live Stock.*—The Cattle Horn Fly, which a few years ago caused such extensive losses to dairymen and stockmen in eastern Canada, has now reached the Pacific coast. Although still occurring in some numbers in the eastern provinces, its most severe attacks in 1903 were in British Columbia, where I found it last summer extremely abundant in some localities on Vancouver Island. Cattle-owners were not prepared to use the remedies which have proved to a large measure effective in the East; but, when these were applied, relief was soon apparent. The most convenient remedy in our experience, is to smear the animals on the parts most attacked with a light dressing of pine tar, one pound mixed with five pounds of lard or half a gallon of fish oil.\* Specimens of the fly were sent from Regina by Mr. Willing, which he had taken on horses; but I saw no annoyance either to cattle or horses during a long journey through several of the cattle districts of the North-west in June and July last. I am hopeful that it is hardly likely this insect will ever be a very serious pest of stock in the dry regions of the West, where the cattle droppings, in which only the fly propagates while these are in a semi-fluid condition, dry up so quickly that they are soon unsuitable for the larvæ to live in.

*Meetings.*—Whenever official duties would permit of my absence, no opportunity has been lost of meeting farmers and of attending meetings of farmers' institutes and agricultural associations of various kinds. The subjects treated of at these meetings were as stated below:—

December 26 to 29, 1902: Washington, D.C.—Association of Economic Entomologists: 'Can the Pea Weevil be Exterminated?'; 'Injurious Insects of the Year in Canada.'

Through the kindness of the President of the Association, a special discussion was held on the former of these papers, and co-operation was promised by several of the entomologists at the United States experiment stations, in disseminating information and in applying remedies for the Pea Weevil in those States where pease are grown for seed.

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\* This mixture contains twice as much pine tar as in former recommendations. We have found that it keeps off the flies much longer than the old mixture of 1 lb. in 10 lbs. of lard.

December 29, 1902: Washington, D.C.—Society for the Promotion of Agricultural Science: 'Co-operation in Fighting Insects.'

January 5, 1903.—A series of addresses on the Value of Nature Study in Schools was given at the school houses in the following places: January 5, Harmony, Cedardale and Oshawa. January 6, U. S. S. No. 4, Whitby; U. S. S. No. 5, Whitby and Kinsale. January 7, U. S. S. No. 1, Pickering; U. S. S. No. 4, East Pickering and Pickering Village. January 8, Pickering, Frenchman's Bay and Dunbarton. January 9, Audley, Brock Road and Cherrywood. January 10, a large meeting in the town hall at Whitby. At all of the above meetings I was accompanied by Mr. W. A. Dent, who delivered most interesting addresses upon the habits of birds. These meetings were organized to help the children of this district in competing for the prizes offered by the Live Stock Commissioner at the Whitby Model Fair.

February 18 : Toronto.—Canadian Association of Fairs and Exhibitions : 'The Value of School Children's Exhibits at Fairs.'

March 6 : Pembroke High School.—'The Value and Pleasure of Natural History Studies.'

March 16 : Toronto.—Canadian Institute : 'Rocky Mountain Plants and Insects.'

March 18 : Cowansville, Que.—(1) 'The Brome Corners Weed Exhibit and its Lessons'; (2) 'Fodder Plants Suitable to the Eastern Townships'; (3) 'Spraying to prevent Insect Injuries.'

March 21 : Toronto Teachers' Association.—'Nature Study, What is it?'

April 3 : Renfrew.—'Why should boys and girls study Nature?' A mass meeting held in the city hall. Renfrew Horticultural Society : 'What Everyone can do to Improve the town he lives in.'

May 11 : Hamilton Horticultural Society.—'Seasonable Hints on Insect Enemies.'

May 14 : St. Catharines district.—Examining orchards which had been treated with the McBain Carbolic Insecticide for the destruction of the San José Scale, in company with some members of the Ontario Fruit Growers' Association.

June 15 to August 21.—In the West, investigating an outbreak of locusts in Manitoba, and holding a series of farmers' meetings in the North-west Territories and in British Columbia.

September 3 and 4 : Ottawa.—Entomological Society of Ontario : 'Insects Injurious to Ontario Crops, 1903'; (2) 'Entomological Record for 1903.' At this meeting a paper was also read by my assistant, Mr. Gibson, entitled 'Basswood, or Linden, Insects.'

September 16 : Whitby.—Attending the Central Ontario Model Fair and judging the natural history exhibits sent in by school children. Delivered an address in the evening at a public meeting upon 'The Children's Exhibits at the Fair.'

September 29 : Richmond.—Opening the Model Fair for Eastern Ontario. Address: 'Model Fairs and their Management.'

November 25 and 26: Leamington, Ont.—Ontario Fruit Growers' Association: (1) 'Insects Injurious to Fruit Trees and how to Fight them'; (2) 'Insects affecting House Plants.'

*Correspondence.*—The correspondence of the Division has been of the usual varied nature and as heretofore has taken up much of the time of the officers. Many of the letters written are practically articles upon special subjects which are suitable for publication in the press, and have frequently been made use of for this purpose, in that way reaching a larger number of interested readers than could be done by direct correspondence. From December 1, 1902, to December 1, 1903, the number of letters, exclusive of circulars, registered as received is 3,150, and the number despatched, 2,664.

*Acknowledgments.*—As in previous years, I take pleasure in gratefully acknowledging my obligation to many correspondents, to practical farmers who have much aided the work of the Division by promptly reporting outbreaks of injurious insects and



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noxious weeds, and for making, at request, special observations upon these. I must particularly mention in this connection, Prof. John Macoun, of Ottawa, who has on many occasions helped me with the identification of specimens, and also Dr. L. O. Howard, the U.S. Entomologist, Dr. Harrison G. Dyar, of the U.S. National Museum, and Mr. B. T. Galloway, of Washington. My thanks are also specially due to Dr. J. B. Smith, of New Brunswick, N.J., who has examined and named for me large numbers of Noctuidæ taken in Canada.

In conclusion, I take pleasure in again testifying to the excellent work done by my assistants, Mr. J. A. Guignard, B.A., and Mr. Arthur Gibson, to whose loyal and careful work much of the success of the work of the Division is due.

I have the honour to be, sir,

Your obedient servant,

JAMES FLETCHER,

*Entomologist and Botanist to the Dominion Experimental Farms.*

## DIVISION OF ENTOMOLOGY.

### CERIALS.

Weather conditions during 1903 in all parts of the Dominion have been somewhat unusual, and crops of all kinds, particularly cereals, have suffered somewhat from this cause. Crop reports from the eastern provinces record a prolonged spring drought with frosts in some places, which in Prince Edward Island and Nova Scotia somewhat thinned fruit crops and retarded growth of hay and pastures. A noticeable absence of injurious insects, with the one exception of cutworms, is mentioned by numerous correspondents in the maritime provinces. In Manitoba, conditions at sowing time were exceptionally favourable and all crops were got in and started well. The weather up to the middle of May was somewhat cool, and there was not much growth of grass and no trees were in leaf. After that time copious rains fell, which germinated all seed and gave promise of an enormous crop. The dry June which followed, with only light showers in July, checked the growth somewhat and, in districts where there was too little rain, grain was prematurely ripened. The result was that crops were rather lighter than usual, and in some districts both in Manitoba and the North-west Territories, where rain fell late in the season, crops did not ripen early enough to escape injury. The handsome gross yield, however, of fifty-seven million bushels of wheat, with an average of over 18 bushels to the acre, in conjunction with the higher price of wheat, gave the farmers of Manitoba and the North-west good returns for their work. In British Columbia Mr. J. R. Anderson reports that all grain crops were good and free of injury by insects. In Ontario the growing of wheat has decreased considerably during the last two or three years. This is doubtless due to losses from the Hessian Fly. In 1900, 1,068,000 acres were put in to fall wheat and 377,000 to spring wheat, while in 1903 only 665,000 acres of fall wheat were sown, with 248,500 of spring wheat. Prof. James, in his November crop report, for Ontario, says: 'The yield of fall wheat per acre is large and the quality of the grain is, as a rule, first class. Taking both yield and quality into consideration, the crop of 1903 may be considered as one of the best in the history of the province. There has been a greatly increased area of wheat sown this fall, more particularly in the Lake Erie district and other localities where the Hessian Fly did so much injury during the previous three or four years. The crop of spring wheat may be counted as above the average, although not so good relatively as fall wheat.' Oats, in all parts of the Dominion, were a heavy crop, but in some places were late in maturing and rather light in weight. No injury by insects, either to this cereal or to barley, was mentioned, and only very few references were made to rust, notwithstanding the heavy rains in some districts. The season of 1903 was not very favourable for corn. Seed planted early did best; that which was put in at the ordinary time, germinated very poorly from lack of rain and was consequently late. The long open autumn, before severe frost came, gave an opportunity for the crop to mature well, and most of it was saved in good condition, both for the bin and the silo.

Pease, which for several years have suffered so severely from the Pea Weevil, were grown to a much smaller extent in Ontario than for many years. In 1903 there were 125,500 acres less land sown to this crop in Ontario than in 1902; but the crop reaped was 1,259,971 bushels above that of 1902, with an average of 22 bushels per acre, against 14½ the previous year. This improvement, it must be acknowledged, is to some extent due to the campaign against the Pea Weevil, organized by the officials of the Ontario Department of Agriculture and this Division. Many farmers and others who grew pease, demanded from their seedsmen seed pease which had been treated to destroy any

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living weevils which might be contained in them, and the present satisfactory state of affairs emphasizes the importance of treating all seed before sowing it, and of insisting that all who sell pease should attend to this matter. If a little more effort is now put forth, I see no reason why the Pea Weevil should not be entirely wiped out in Ontario. The remedies which will, in my opinion, effect this, were given at length in my last report, and consist of sowing early, so as to hurry on maturity as soon as possible, reaping directly the crop is in a fit condition, threshing and fumigating with bisulphide of carbon at once and then bagging up the seed and keeping it in bags until required for use. If it is not considered convenient to fumigate the seed before sowing, all the weevils can be destroyed by sprinkling a little coal oil or turpentine over the seed and turning it well for two or three days before sowing, or the seed may be held over till the second year, when it will be quite free from weevils, because these always emerge at latest by the spring of the year following the season when they develop.

The GRAIN APHIS (*Nectarophora granaria*, Kirby=*Siphonophora avenæ*, Fab.).—The only insect which was complained of as having occurred in undue numbers on cereal crops during the past year was the well known Grain Aphis, or 'green fly.' There is no doubt that where this occurred early in the season some injury was done to growing wheat and oats, but for the most part, although the aphides were exceptionally abundant, the usual parasites accompanied them, and in a short time they entirely disappeared.

'Avenæ, Man.—The Grain Aphis was extremely abundant on wheat and oats this year. They attracted our attention during the first week in July and later they were so plentiful that they wetted all the front part of the binder canvases, on which they could be gathered up in handfuls. Mr. Sutcliffe, of Treesbank, tells me that they were so abundant on his oats that they actually stopped the binder. On looking beneath the canvases, he found the rollers simply packed with smashed up plant-lice. These insects undoubtedly did considerable harm this year by sapping the vitality of the plants, thus preventing the heads from filling as well as they should have done. As usual, numerous parasites were present with these and the many other kinds of aphis which appeared on various plants this year. By the end of the season, the parasites had almost exterminated these.'—NORMAN CRIDDLE.

Samples and reports of the presence of the Grain Aphis were sent in from many places in Manitoba and eastern points in the North-west Territories, as well as from a few places much further west. It was reported as being unduly abundant in Manitoba, at Bagot, by Mr. Eli Roberts; at Portage la Prairie, by Mr. James Thompson, and at Miami, by Mr. Thos. Renwick, who spoke of it as general throughout that district. The farthest point west where injury was done was at Beaver Dale, N.W.T. (34.26.7 west of 2nd meridian), from which place specimens were sent by Mr. Geo. Fernie. At Ottawa large numbers of the Grain Aphis were found on wheat and oats at the end of July, and it was noticed in the experimental plots here that certain varieties of wheat were more attractive to the insect than others. As a general thing, the bearded varieties were found in this observation to be much less infested than bald wheats. In every instance, large numbers of parasites were found present with specimens sent in for examination. In our Ottawa fields these were represented by the

following species of Hymenoptera: *Asaphes vulgaris*, Walk., *Lygocerus niger*, How., *Xystus* (*Allotria*) *tritici*, Fitch, *Aphidius avenæ*, Fitch, *Pachyneuron*, sp. There were also numerous specimens of the common coccinellids *Adalia bipunctata*, L., *Hippodamia convergens*, Guér., and the Thirteen-spotted Lady-bird Beetle (*Hippodamia 13-punctata*, L.), and of the Hovering Fly *Syrphus ribesii*, L.



Fig. 1.—Lady-bird Beetle: a, larva; b, pupa; c, perfect insect.



Fig. 2.—The 13-spotted Lady-bird Beetle—enlarged.

WHEAT-STEM SAWFLY (*Cephus pygmaeus*, L.).—An insect which appears in a rather intermittent manner in Manitoba and the North-west Territories is the Wheat-stem Sawfly. Although present in considerable numbers in a locality one year, it seldom appears again in the same place the following year. It has from time to time been reported from Central Manitoba right across the plains to the Rocky Mountains. There are, I believe, other species of *Cephus* which attack various grasses in the West. In 1902, Mr. Norman Criddle sent me from Aweme, Man., a large number of stems of two grasses, *Amphipha longifolia* and *Agropyrum caninum*, which were attacked by Cyphid larvæ. Judging from the colour—one was bright yellow and the other white like the Wheat-stem Sawfly—there were at any rate two species; but, unfortunately, I failed to rear any of the flies from the large amount of material sent me by Mr. Criddle. During the past season I received several infested wheat straws from Mr. John Davis, of Waskada, Man., who wrote:—

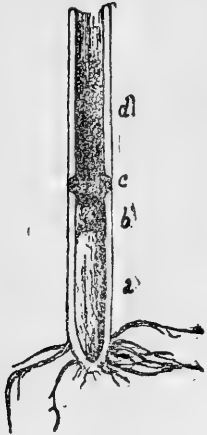


Fig. 3.—Wheat-stem Sawfly: a, cocoon, b, borings.

August 19.—I am sending you a few stems of wheat which I and many others here would like you to report upon. You will notice that some of the straws are broken or bent down three or four inches from the ground. The cavity of the straw is full of fine dust, and there is a small white grub about half an inch in length. This I have generally found low down quite near the root. It is very general through this district, but is not very destructive. The straws fall as they get dry, and where the attack is slight it might easily pass unnoticed. I have one field of 45 acres summer-fallowed last year. We were estimating this to yield 30 bushels to the acre. There is about 5 per cent of this field down. I have not seen any other field so badly attacked as this is, but I have not seen any field about here that is quite clear of injury. It is a new pest here, and no one seems to know anything about it.

This insect has provisionally been named *Cephus pygmaeus*, L., and it certainly bears a close resemblance to that European species; but there are some points in its habits and life-history which do not agree, and it is just possible that the insect which occurs in our North-west may be a native grass-feeding species which occasionally attacks wheat when it finds that plant in a suitable condition at the time the females are laying their eggs. This can only be proved by carefully rearing a large series of the insects. The perfect insect is a shining black four-winged sawfly, banded and spotted with yellow, and having the abdomen slightly compressed. The head is large, with prominent eyes, the antennæ slightly club-shaped and composed of about 20 segments. The female is rather larger than the male and less ornamented with yellow. The average length of this fly is about one-third of an inch. The eggs are laid probably about the 1st of July, just before the wheat comes into head. They are inserted into the hollow of the stem by means of the female's saw-like ovipositor. The egg hatches in a few days, and the larva grows rapidly; before the straw ripens and hardens it will have eaten its way from the topmost joint of the stem to the lowest, feeding on the substance of the knots and on the inside tissues of the straw. About the time the grain ripens, it goes down to the lowest joint and gnaws away the inside of the straw so as to cut a ring almost, but not quite, through to the outside. This is just above or at the surface of the ground. The larva then burrows further down into the base of the stem and spins a very fragile skin-like cocoon, in which it remains unchanged until the following spring. The date of appearance of the perfect insect varies with the season and locality. I have taken specimens by sweeping, both in grain fields and on the prairie, from the last week of June to the middle of July. As all the larvæ pass the winter in the base of the straw, remedial measures must aim at treating the stubble

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so as to destroy them or the pupæ before the flies emerge. I have suggested that this may be done either by ploughing deeply or by burning over the stubbles. As a few of the cocoons occur high enough up in the straw to be cut with the grain, all straw which cannot be used during the winter should be burnt.

The HESSIAN FLY (*Cecidomyia destructor*, Say).—This destructive insect, which a few years ago was the cause of such extensive loss in the fall wheat-growing districts of Ontario, was hardly noticed during the past season. Prof. Lochhead, of the Ontario Agricultural College, writes: 'This pest of wheat, barley and rye is no longer a serious enemy in the province. It has only been observed in one or two localities during the past season. In the vicinity of Georgetown it did much damage in wheat grown on stubble. A correspondent writes: "In good crops very little harm was done. On one occasion, in passing along the road, I noticed in a badly injured field that there was one very luxuriant patch of grain. I examined this patch, where evidently a pile of manure had lain, and found that the straw and grain were in good condition. I could not find a single stalk infested by the Hessian Fly." Most farmers are practising late sowing, that is about September 15. This probably had a good deal to do with the disappearance of the Fly.'

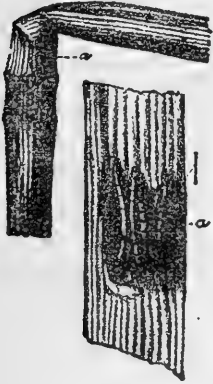


Fig. 4.—Hessian Fly: 1, injured wheat-stem; 2, puparia—enlarged.

Reports from Prince Edward Island show that the Hessian Fly was noticeably present in several localities, and Mr. E. J. McMillan informs me that there was a considerable amount of loss in some places. In the West, Hessian Fly was mentioned quite frequently in correspondence from Manitoba and the Territories, but I believe that there was a confusion, in some instances at any rate, with the work of the Wheat-stem Sawfly. The only account of a serious outbreak was from Beulah, Man., where Mr. A. J. Dennis reports that 'the Hessian Fly has been much thicker this summer than I ever saw it.'

On the whole, however, there was probably not quite so much injury in Manitoba this year from Hessian Fly attack as in 1902. As has been frequently stated, there is normally only one annual brood of the Hessian Fly in Manitoba; consequently, the remedy is comparatively simple as compared with Ontario and the eastern provinces, where the insect is carried over in fall wheat. When Hessian Fly is known to be present in a district the grain should be cut high and the stubble burned over or ploughed down in autumn, and straw should be fed or burnt before the time the flies emerge the following spring. Screenings and rubbish from threshing machines should be put where poultry can get at them or where they will be trampled into the ground during the winter by stock.

## LOCUSTS.

Locusts, or grasshoppers, which have been the cause of much anxiety in Manitoba during the past three years, again appeared last spring in the same localities as previously. They were so abundant that the provincial Minister of Agriculture again thought it wise to help farmers with advice and to supply Paris green for poisoning them with. Mr. Hugh McKellar, the energetic Chief Clerk of the Department of Agriculture, by instruction of his Minister, visited the infested districts and made arrangements for the distribution of poison. This was taken advantage of by many farmers, who used the Criddle Mixture with great satis-



Fig. 5.—The Rocky Mountain Locust.

faction. Some farmers who had read in the newspapers of experiments in treating grasshopper outbreaks with parasitic fungi, asked that some experiments of this nature might also be tried in Manitoba. The idea of treating outbreaks of injurious insects by means of introducing parasitic insects or fungi is an exceedingly attractive one, and, to those who have never studied these matters, is apparently a very easy solution of a difficult problem. Knowing that many of our leading American entomologists and botanists had made extensive experiments in this direction, but that nothing was being done by these students at the present time, I had not any very sanguine hopes of securing great success in Manitoba; but, as there certainly was a chance of doing good work for the province, I endeavoured to procure some cultures of the so-called South African Grasshopper Fungus for this purpose. After correspondence with many who had experimented, I at last succeeded, through the kindness of Dr. Howard, the United States Entomologist, in obtaining six tubes. These I took with me to Manitoba in June last and placed them in the hands of Mr. Norman Criddle, a careful experimenter and asked him to follow closely the instructions which accompanied them. This work was begun while I was with him and carried out by Mr. Criddle during the summer. Notwithstanding every care, this experiment must be recorded as a failure. I append herewith Mr. Criddle's report upon his work with locusts during the season of 1903.

#### *LOCUST NOTES FROM AWEME, MAN., 1903.*

BY NORMAN CRIDDLE.

There has been throughout this part of the country a marked decrease in the number of locusts during 1903, especially where they were poisoned last season. All the early damage done, which amounted to very little, was owing to many of the stubble fields being last spring devoid of all vegetation, and consequently locusts were obliged to attack the grain much earlier than they otherwise would have done. The first hoppers noticed hatched out on the 3rd May; they were becoming quite numerous by the 5th, and on the 12th the majority were out. They then began to do harm. By the 15th they had swept into some fields in millions, I think, thicker than I had ever seen them before. They had in three days marched 200 yards. Up to this time a small amount of damage was done; but this was principally owing to carelessness, and the insects were soon got under control with poison. By the 5th June most of the locusts had passed the third stage and, owing to the hot weather, it required a good deal of exertion to keep them from the growing grain. Wherever poison had been spread, countless numbers were found lying dead about the edges of the fields. At this period quite a number hatched in the wheat fields, the eggs having evidently been laid on summer-fallow last year. On June 13 most of the locusts were in the fifth stage, and the first one was noted with wings. By July 2 two-thirds could fly and some of them began migrating. By July 6 they could nearly all fly, and many of them flew into the crops. It is at this time that the second stage of the fight begins; the locusts, flying to all parts of the crop, eat the heads of grain. Fortunately, they soon collect into the sunny places, such as where the seeder has missed or any other open spot, so that, by walking up and down the fields, these places can be found and poison spread there. In fact, I am inclined to believe that in localities where locusts are troublesome it would be a good plan to miss a foot or so when drilling for the insects to collect upon. The migrating season was over by July 15, the weather at that time being cold and unfavourable for flying, so that very few left the neighbourhood. On August 1 the first female was noted laying eggs, although egg-laying did not become general until the 11th of that month, from which date eggs were deposited continuously until all these insects had disappeared. This they began to do about September 1, gradually getting less, until by October 3 they had nearly all disappeared. A few remained until the winter set in. The locusts responsible for damage this year were the same as last, and in the same proportion.



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These were the Lesser Migratory Locust (*Melanoplus atlantis*, Riley), Packard's Locust (*M. Packardii*, Scudd.), the Two-lined Locust (*M. bivittatus*, Say), and the Rocky Mountain Locust (*M. spretus*, Uhler).

There is no doubt that the cause of the decrease in locusts was largely due to the co-operative work of farmers with Paris green, added to the increase of two species of Blister beetles, *Epicauta sericans*, Lec., and *Epicauta pennsylvanica*, DeG. This year the first of these insects were seen on June 1, and by the 4th of that month they had become abundant. *E. sericans* occurred on the dry prairies and *pennsylvanica* in somewhat damper spots, wherever the Wild Pea (*Lathyrus venosus*, Muhl.) is plentiful. *E. pennsylvanica* did considerable damage to potatoes and broad beans, but *E. sericans* is in no way injurious; it is, on the contrary, beneficial, as it seems to confine itself almost entirely to lamb's-quarters, though I have seen them actually eating wheat when other food was not to be found. The native food plant appears to be the Crocus Anemone, *Anemone Nuttalliana*, Gr., which I have often seen them eating. These beetles had all disappeared by August 28. That these two species of insects will be the cause of a still greater decrease of locusts next season is, I think, little to be doubted; for, although there are still numerous fertile eggs in some places, and notwithstanding that many locusts remained alive late into the season and there were an enormous number of eggs deposited, still, from observations I have made, I find that at least two-thirds of the eggs have been destroyed by Blister beetles. Of 141 pods examined, the eggs of 97 were destroyed. Of other locust parasites, there was an increase of tachina flies, and the Locust Mite seems to be rather more plentiful than usual. Another friend was Franklin's Gull, *Larus Franklinii*. During the migratory season, between July 26 and 31, thousands of these birds were to be seen flying up and down the fields, particularly on the summer-fallows, busily engaged in picking up locusts. Unfortunately, they were too late to prevent many of the females from laying eggs, although, of course, they did an immense amount of good.

Some damage was caused from locusts eating binder twine; very few had blue-stoned the twine, and we have now been able to demonstrate without a doubt that some brands of binder twine are much more subject to attack than others. Whether it is that certain brands are made of different material or that they are looser than others, I cannot say; but the twine which was most attacked is very loosely twisted.

With regard to what you have called the Criddle Mixture, numerous tests were made with Paris green during the season to ascertain as accurately as possible the strength required to kill locusts, and it was found that one pound of Paris green could be mixed with five patent pails of horse droppings with absolute success. Weaker mixtures were not quite so successful. In the past, I believe a large amount of Paris green, as well as labour, has been wasted through putting out the mixture in cold or wet weather, whereas I find that practically no feeding takes place in the spring with a temperature below 50°F. It is on the hottest days that locusts eat most, and consequently are most easily poisoned. In the early stages locusts much prefer the mixture moist, and I have found that spreading a little every other day, in the morning, gives much better results than scattering a lot at a time, and less frequently. Another advantage of spreading lightly is that the danger of cattle eating it is greatly lessened, whereas when put in lumps the danger is claimed to be considerable.

I regret to say that some cases of cattle poisoning were brought to my notice during the season. Though in every case the loss was the result of either ignorance or gross carelessness, in some cases, through spreading the mixture in too large lumps, or even putting it in pasture fields, or through leaving the barrel or whatever it was mixed in, where cattle could get at it. As I have said more than once, if the mixture is only scattered properly, there will be practically no danger. A good preventive measure is to keep cattle well salted. As Mr. McKellar remarked, 'Some farmers are ever-generous with salting their grasshoppers, but neglect their cattle. This is a fact.

*Locust fungus*.—I am sorry to say that the tubes of the fungous locust disease left in my care, proved a complete failure. One failed to show any signs of growth, but

the others were perfectly fertile. The first culture was mixed in sugar and water and was left in a warm place, as directed, until it showed signs of growth, when it was put out as follows: (1) Scattered among the grass infested by locusts; (2) locusts were caught and dipped in it; (3) it was put on pieces of horse droppings, bran and other attractive food, the weather at the time being very dry. Locusts after being dipped in the culture were kept in a large box for some days, but showed no signs of being any the worse for their treatment. The second culture was put out on the evening of July 22, during damp and rainy weather, though rather cold. It was spread among the locusts in the same way as the first. Two locusts were found dead, possibly as a result of this, three days after it had been put out.

The third lot of fungus was put out on July 15, in the evening when considerable dew had fallen. No results were observed. Another lot was put out on the 16th. This was mixed in bread crumbs, some of which was eaten by locusts; but no dead insects were found. During the time several locusts were found which had been killed by the native fungous disease in spots widely removed from one another and at long distances from where the experiments were being conducted, showing that the weather conditions were at least fairly favourable for this work, and also that this disease is probably always present and makes its appearance as soon as the conditions are favourable. The last lot of fungus was put out on August 2 in the same way as the first.

No results were noticed.—NORMAN CRIDDLE.

Referring to the above statement that cattle have been poisoned by the Criddle mixture, it need hardly be pointed out that, with this remedy as with every other in which an active poison is used, at any rate ordinary and reasonable precautions must be taken to prevent stock of all kinds from eating the material. It is well known that horned stock will, if allowed to do so, eat the bedding from a horse stable, but this can hardly be recommended as a good food for the production of milk, and the practice should be prevented. If the Criddle mixture is distributed in the manner recommended, that is, for the material to be scattered loosely through the plants at the edge of a field of standing grain, it can hardly be said that there is any danger. One instance came to my knowledge of a man in Manitoba who had mixed half a barrel of the Criddle mixture, part of which he did not use. The half barrel containing this was put in his barn and left there till threshing time, when, to make room, it was turned out into his yard where he had some cows. Some of these ate the poisoned material and died from its effects, but this instance of carelessness can hardly be cited as a reason for not using this most useful remedy against grasshoppers. If it is, it means that the use of active poisons such as Paris green and many other compounds now thought to be necessary to the fruit-grower and farmer, and the whole operation of spraying, would have to be condemned. On occasions when farmers have been using the Criddle mixture, which is in every way the cheapest effective remedy for grasshoppers which I have ever tried, if there is any of the material left over, it should be scattered loosely over a piece of land where its fertilizing effects may be secured and where there will be no danger of poisoning animals.

The only other place in Canada where grasshoppers were noticed in numbers was in the Okanagan valley of British Columbia. Mr. E. P. Venables, of Vernon, writes: 'Grasshoppers were numerous at some places, and, although no appreciable damage was done, some people are anxious lest there may be a repetition of the plague of three years ago. Some of their enemies, however, were in evidence to an equal extent with the grasshoppers. Among these, the Spotted Gray Blister-beetle (*Epicauta maculata*, Say) was very abundant, feeding upon wild plants. Therefore, it is to be hoped that their larvæ will help, if they keep up their good name for destroying the eggs of grasshoppers.'

The Criddle mixture, as modified in accordance with the latest experiments, consists of one part of Paris green, mixed thoroughly in 100 of fresh horse droppings, to which two pounds of salt per half barrel of mixture have been added, after being dis-

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solved in water. This is placed in a half barrel and drawn on a cart to the edge of an infested field or one likely to be infested. The mixture is then scattered broadcast along the edge of the crop by means of a trowel or wooden paddle. The locusts are attracted to it from long distances and are killed in large numbers by eating the poison.

## FIELD CROPS.

The CLOVER SEED-MIDGE (*Cecidomyia leguminicola*, Lintner) has been the cause of very serious loss to seed growers in all parts of Ontario where clover seed is produced. Probably one-half of the crop was destroyed by this insect. In some districts the whole crop was completely ruined. The remedy of feeding off or mowing the first crop of clover before June 20 has been found satisfactory by all who have tried it. The reason of this is that the maggots of the first brood come to maturity towards the end of June, and then leave the clover heads to enter the ground, where they complete their changes; and if the clover is cut or fed off before that date, the immature larvæ are destroyed. If the clover is left standing later than June 20, the maggots will have time to complete their growth and leave the clover heads. From these larvæ the second brood which attacks the seed of the second crop is produced. Just about the time the seed is ripe, the larvæ of the second brood fall to the ground and burrow beneath the surface, where they pass the winter, the flies emerging in June of the following year and laying their eggs in the flower heads soon after these form.

The HOP APHIS (*Phorodon humuli*, Schrank).—It is many years since serious complaint has been received at the Division of excessive injury by the Hop Aphis. In the extensive hop fields of British Columbia there is an occasional outbreak, but the excellent crops of the last few years and the high price which has been secured for British Columbian hops, shows that this crop has been produced to great perfection and without serious injury from insects. In some of the plantations in the valley of the Fraser it has required constant attention on the part of growers to keep the 'Red Spider' under control; but this has been done to a reasonable extent. The sovereign remedy for all mites, of which the so-called Red Spider is one, is sulphur in some form, either as flowers of sulphur mixed in the ordinary quassia and tobacco wash, which is pretty generally used as a remedy or a preventive of Hop Aphis, or distributed as powder through the plants. A new pest which has appeared in sufficient numbers this year to be noticed in British Columbia is *Psylliodes punctulata*, Mels., a small flea-beetle which was sent in by Mr. H. Hulbert, of Sardis, B.C., under the name of the Hop Flea-beetle. This has been referred to briefly as a hop pest in Bulletin No. 4, old series, of the United States Division of Entomology.

Some years ago hops were grown to a large extent in Prince Edward County, Ontario; but of late years the industry has been to some measure given up for the cultivation of other crops. Some growers, however, have continued to grow hops, and quite recently others were resuming the practice. During the summer of 1903, which, as has been stated already, was particularly characterized by the abundance of many kinds of plant-lice, the hop yards of Ontario have suffered from a serious visitation of the old-time enemy, the Hop Aphis. Through the kindness of Mr. John D. Evans, of Trenton, I have received a great deal of information concerning this outbreak, and he has been good enough to visit and interview several of the growers who were most interested in this subject. I have also received from Mr. W. B. Cooper, of Bloomfield, Ont., who has been for many years an extensive grower of hops, a detailed account of this outbreak. Mr. Evans writes:

'Trenton, Nov. 23.—Mr. H. S. Miller, of Picton, who is a large dealer in hops, and who visited many of the hop yards at different times during the past season, states that the total hop crop in the district this year yielded only 46 tons; last year, with

the same acreage, it was 128 or 130 tons, and that at least two-thirds of the hop acreage this year was afflicted with the pest. Although the loss was severe in some places, it was not general throughout the district; for instance, Mr. Branscombe, of Chisholm, only got two bales from three acres, his crop being almost a total failure. He stated that the insects appeared first of all as plant-lice when the hops were coming into burr. After that it seemed as if a blight had struck them; the vines which were affected produced no hops, and the leaves turned black. On a knoll in his yard the vines were heavy and produced the two bales referred to. Then, on the other hand, Mr. Philip Vanmeer, of Bethel, Ont., had 22 acres of hops. The centre of his yard was on high ground, but the land sloped off in all directions to low ground. His yard was not affected, and he did nothing in the way of spraying or otherwise, in the way of special treatment, except that the yard was kept thoroughly cultivated. He had a very heavy crop. It would appear, then, that the abundance of this insect is not affected by the land being high or low. A great many ladybird beetles were present among the aphides. There was a similar visitation by the Hop Aphis in 1886, when the hop crop was almost ruined; but since that time the insect has occurred only in very limited numbers and has not been noticed. None, or very few, of the growers here have done any spraying, as they have not the special apparatus which is necessary. I am told that the spraying pumps which answer for fruit trees will not for hops.'

Mr. Henry Corby, of Belleville, Ont., as far as I can learn, was the only grower who sprayed his yards in a thorough way to protect them from injury by the Hop Aphis last year. His experience, however, has been so widely commented upon by hop growers in the vicinity and in Prince Edward county that I have no doubt the wise measures adopted by Mr. Corby will have the good effect of inducing others to spray their yards next year, should there be any appearance of the Hop Aphis. Mr. Corby writes:

'Belleville, Nov. 19.—Your favour in *re* Hop Plant-louse received. In reply we first noticed the Hop Plant-louse on the vines about the 1st July. From the 1st to the 10th they came on very thickly indeed. As I had eighty acres under cultivation, we continued the spraying for close on to a month. The mixture I used, was 7 pounds of whale-oil soap and 8 pounds of quassia chips, boiled for an hour. This made 100 gallons of wash. I used an English sprayer which takes two horses to draw it, but it does thorough work. I consider that I lost one-quarter of my crop at least; but, had I not used the sprayer, I doubt if I should have had any hops at all. The quality of my hops is first-class.'

The life history of the Hop Aphis is a remarkable one and is given in a condensed form in my annual report for 1889, which I repeat herewith, as the life history has an important application in this species, to the remedies which are suggested. The life history of the Hop Aphis has been carefully worked out by Prof. Riley and recorded in his report for 1888 as follows: 'Of this species the winter eggs are laid by the perfect females upon plum trees in autumn. From these hatch, the following spring, wingless females which are called "stem-mothers." These produce young plant-lice by a process analagous to budding in plants and known as parthenogenesis (from the Greek *parthenos*, a virgin, and *genesis*, production), which means the production of young from imperfect and unimpregnated females, without the intervention of a male. There are three broods of these parthenogenetic females produced on various kinds of plum trees, the third becoming winged. This last is known as a migrant and it instinctively flies to the hop plant, which up to this time has been free from attack. A number of generations of wingless females are produced upon the hop until, in autumn, winged females known as the return migrants again appear. These return to the plum and produce some three or more young which have no wings but are true sexual females. Somewhat later than this, upon the hop vines true winged males, the only males of the whole series, are developed. These fly to the plum trees and towards the end of the season may be found pairing with the wingless females, which afterwards stock the tree with eggs which pass the winter there.'

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The above life history will show how complex and difficult to understand are the habits of some of our injurious insects. The importance of this knowledge, however, cannot be over-estimated ; for it is plain that, if the Hop Plant-louse passes the winter in the egg form upon plum trees, by having no plum trees near the hop yard, the opportunities for the insect to increase in a certain district are much reduced, and, further, that, if plum trees near hop yards are treated during the winter to destroy the eggs, a very large proportion of the infestation can be wiped out. It has frequently been noticed by farmers and others with what enormous rapidity the different kinds of plant-lice sometimes increase. Dr. Wm. Saunders, in the annual report of the Entomological Society of Ontario for 1878, refers to this matter as follows:—

‘Some idea may be formed of the numbers to which in a short time plant-lice increase, from a calculation of Curtis, the celebrated English entomologist, who computed that from one egg only there would be produced in seven generations, taking thirty as the average of each brood, the enormous number of 729,000,000, so that, were they all permitted to live, everything on the face of the earth would in a short time be covered with them. Indeed, sometimes the possible rate of increase is even greater than this. Dr. Fitch, the state entomologist of New York, ascertained by actual experiment, that the wingless females of the Grain Aphis became mothers at three days old, and thereafter produced four young ones every day, so that even in the short space of twenty days the progeny of one specimen, if all were preserved from destruction, would number upwards of two millions.’

Some of the useful facts derived from a knowledge of the life history of the Hop Aphis, are that, as the eggs are laid upon plum trees and pass the winter there, it is important not to allow wild or useless cultivated plums to grow round hop yards ; but, if these trees are growing in the vicinity and it is impracticable to destroy them, the value of treating these before the eggs hatch, or just at the time the young plant-lice are hatching in May, with kerosene emulsion, or a whale-oil soap solution, is manifest. As the males are only produced at one season of the year and this on the hop plants after the females have migrated to plum trees, the utility is plainly shown of burning up at once after the crop is picked all the vines and leaves of the hop plants. In this way, it is believed that so many of the males will be destroyed that there will not be enough left to fertilize all the females which have flown away to the plum trees. Although plant-lice can produce young for a long time without the intervention of males, when the time comes for the perfectly sexed females to be produced, the males are necessary for the fertilization of the over-wintering eggs.

As there are three broods produced upon plum trees subsequent to the hatching of the eggs, it is not until comparatively late in the season that the plant lice appear upon the hop vines. It is an important observation then to know exactly at what date this migration from the plum trees to the hops takes place, because these insects are exceptionally prolific and multiply with enormous rapidity as soon as they reach the hops. Consequently the sooner the plants are sprayed to destroy the aphides the easier that work will be accomplished and naturally at a much smaller loss of vitality to the plants. In New York State the migration from the plum trees to the hops takes place in the month of May, so it is probable that this may also be expected about the end of that month, or early in June, in southern Ontario.

As to the best insecticide for controlling the Hop Aphis, there are several which may be used. Kerosene emulsion diluted to as weak a wash as one part to twenty-five of soft water, will kill the insects upon the foliage at the time they migrate to the hop plants. This strength will not injure the leaves, which it is stated is the case with stronger mixtures. To destroy the winter eggs on plum trees a much stronger mixture of the emulsion, viz., one to six, is necessary. Instead of the above, whale-oil soap, one pound to six gallons of water, may be used on the hop vines. The remedy, however, which is by far most generally used by hop growers in England, California and British Columbia, is the one which has been styled the ‘English wash,’ and is the stan-

dard remedy for the Hop Aphis in the hop gardens of the south of England. It is very similar to the one used by Mr. Corby, mentioned above :

100 gallons of soft water (if the water is hard add soda).

4 to 5 lbs. of soft soap.

6 to 8 lbs. of quassia chips, first steeped in cold water and afterwards boiled for one hour before mixing with the main supply of water.

The value of this wash has been clearly shown in England, where some hop-growers, as is the case with ourselves, do good careful work and get large and paying crops of hops of the first quality, while others who do not attend to these important matters get nothing at all or very little. The points most to be borne in mind by hop growers in this connection are,—that early work is less troublesome, less expensive, and pays enormously all trouble taken, therefore constant attention must be given to the yards at the time the insects migrate to them, and lastly, that one application of any remedy is not sufficient. The washes effective against plant lice, unlike the arsenical poisons which are placed on foliage and remain active for a long time until eaten by insects, are contact remedies only which, to be of any use, must actually be thrown on to each individual insect ; moreover, as the plant-lice do not all migrate to the hops at the same time, two or three applications at short intervals may be necessary. Throughout the summer the various broods of the hop aphis are wingless, therefore, if the first broods which appear on the hops are thoroughly dealt with, the yards can be kept clear for the rest of the season.

## ROOTS AND VEGETABLES

Roots crops in all the eastern provinces of the Dominion have suffered from the unusual weather which prevailed generally last spring from the lakes to the Atlantic coast. The dry late spring prevented prompt germination of seed when sown early. Mangels were not up to average, from poor germination and the attacks of cutworms, Sugar beets, which are now being grown in many parts of Canada both for sugar and for stock, gave a fair crop. Turnips, where not injured by cutworms and the Turnip Aphis, gave good returns, particularly from late sowings put in after the June rains. Potatoes did not start well, owing to the drought of May and early June. The crop, however, was fairly good in size and quality, where not injured by the 'Potato Rot.' This disease, which can to such a large extent be prevented by spraying with Bordeaux mixture, as has frequently been pointed out in these reports, was, it is to be regretted, very destructive from the Maritime Provinces to the Prairies. The following extracts from Mr. B. W. Chipman's Nova Scotia government crop report for November last, are well worthy of consideration by the thousands of farmers and others who grow potatoes either in large or small quantities :—

'Chester.—The potato crop will be heavy and of large size, but the rot has begun in some places very badly. Early spraying with Bordeaux mixture has proved beyond doubt a preventive for blight rot, and should be thoroughly tested by all potato growers. The trial costs little and the result in this district has proved its value. Spray as soon as the plant is in blossom, and twice at intervals of two weeks later on, if the season is wet.'

'New Germany.—No potato bugs. Potatoes took blight about September 1, and in some cases 50 per cent are rotten. One man here, and only one, as far as I know, sprayed his potatoes, with the result that less than 1 per cent were rotten.'

The results of demonstration experiments which have been carried on at the Central Experimental Farm, Ottawa, year after year, for many years, have uniformly shown the enormous benefit of spraying potato vines about August 1, and twice afterwards at intervals of 15 days, with the Bordeaux mixture, which for this purpose con-



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tains bluestone, 6 lbs.; unslaked lime, 4 lbs.; Paris green (to destroy leaf eating insects) 4 ozs., and soft water 40 gallons.

In the Ontario crop report for November last, Prof. James refers to the prevalence of the potato rot and estimates the loss at from 10 to 60 per cent in various localities. Mangels were in some places replaced by turnips, where the seeds had not germinated well, and turnips, although yielding a good crop, were in many quarters considerably injured by the Turnip Aphis.

The Colorado Potato Beetle was reported from all sections as being less abundant than for many years. The following reports are representative of many others received:—

'Charlottetown, P.E.I.—Root crops were badly injured by cutworms, and many fields were resown for the third time; some land was ploughed up and sown to other crops. The yield of roots was fair on the decreased acreage; the cutworms seem to have been general over the whole province.'—E. J. McMILLAN.

'Halifax, N.S.—Roots and vegetables good; potatoes above the average. No complaint of injurious insects on potatoes except the potato bug, and that was not as bad as usual. In some places, mangels, beans and vegetables were injured by cutworms. Turnips were somewhat attacked by aphids.'—B. W. CHIPMAN.

There were not many large fields of roots this year in the province of Quebec. Many thought that it was too late after the rain came to bother with roots, so on the whole there will not be a very large crop. Some few have fair pieces.'—PETER MACFARLANE.

**ROOT MAGGOTS.**—Among vegetables, considerable injury has been done in nearly all parts of the Dominion by root maggots. The Cabbage or Radish Maggot, and the Onion Maggot, which for all practical purposes may be treated of as the same species, caused great loss in crops of cauliflowers, early cabbages, turnips, radishes and onions. The occurrence, however, was irregular, much harm being done in spots, while in another not very far distant there was no appearance of the attack. There is nothing new so far in the shape of a remedy for these insects when large areas have to be treated; but some experiments which have been carried on by the Horticulturist at the Central Experimental Farm during the past summer with the object of producing early tobacco and vegetables of high quality, have an important entomological bearing which is well worthy of mention. An enclosure was made of a light framework of wood, six feet in height, and covered entirely on the top and along the sides with cheese cloth. In this tent tobacco and various kinds of vegetables were sown, or planted, and a similar duplicate plot was also planted

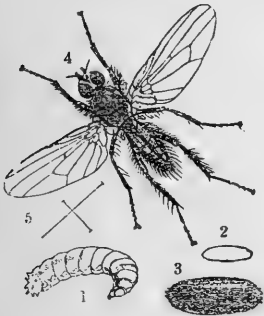


Fig. 6.—Cabbage Maggot: 1-3, maggot and pupa case; 4, fly—1, 3 and 4 enlarged.

just outside with the same conditions of soil and soil moisture. The rows of this plot were practically in continuation of those inside the enclosure. This experiment was satisfactory, both as to forcing the plants forward to earlier maturity, and on account of the important discovery made by Mr. Macoun that this cheap protection prevented entirely the attacks of many kinds of injurious insects. Radishes, onions, cabbages and cauliflowers developed well and were absolutely free from root maggots. Nothing was attacked by the troublesome Tarnished Plant Bug (*Lygus pratensis*, L.) or the Four-lined Leaf Bug (*Pæciloscapsus lineatus*, Fab.). Cucurbits of all kinds were entirely free from injury by the Striped Cucumber Beetle. In fact, this experiment has furnished us with a sure means of growing many vegetables of which, from the difficulty of getting them into perfect condition, gardeners had in some places given up the cultivation. This is particularly the case with cauliflowers, early cabbage, radishes, onions

and other plants of only moderate height. These could be entirely protected by a framework which any ordinary workman could make, only three feet high and three feet wide for single rows in a garden. With such a covering, it would be impossible to cultivate between the rows; but, if made in sections, these could be removed for that purpose when necessary. The cost of building an inclosure in which a man could work with ease and where several hundreds of plants could be grown, would be little compared with the increased price which would be obtainable for the earlier and much superior crop. Careful handling in taking down and storing away the cheese cloth and framework would insure the lasting of these for at least two or three years. These inclosures are manifestly better suited for the cultivation of some plants than for others; such plants as egg plants and cucurbits, which depend on the intervention of insects for the fertilization of their flowers, would require to be fertilized by hand if grown in these inclosures. A noteworthy result of these experiments was that the vegetables grown within the inclosure were entirely free from attacks of root maggots, while those grown in the corresponding plot outside were badly affected.

Remedies for root maggots are frequently asked for, and those which have been recommended in the past are as follows: For early cabbage and cauliflowers, the best remedy is undoubtedly an early application of the disks of tarred paper recommended by Prof. Slingerland. We use these regularly at the Central Experimental Farm, and always with great satisfaction. Where these have not been put on early, a remedy which may be used is to pour about half a teacupful of a strong decoction of pyrethrum insect powder, four ounces to the gallon of water, around the roots of each plant, after drawing away the earth right down to the rootlets. The earth must then be pushed back again. For onions and radishes, dusting white hellebore along the rows as soon as the young plants appear, has given good results in seasons when the flies are not abnormally abundant. Kerosene emulsion and a solution of whale-oil soap have also been used by some. Another excellent remedy is the carbolic wash recommended by Prof. A. J. Cook many years ago. This consists of boiling up one quart of soft soap or one pound of hard soap in a gallon of water. When boiling, add half a pint of crude carbolic acid. Boil for a few minutes and stir thoroughly. The mixture is then ready to be stored away for future use. When required, take one part of this mixture by measure to fifty of water, and sprinkle or spray directly upon the growing plants once a week from the time they appear above the ground.

The CABBAGE AND TURNIP APHIS (*Aphis brassicæ*, L.).—Although not so injurious as it has been in some previous years, this insect was the cause of considerable loss in

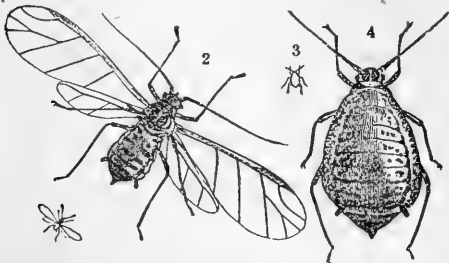


Fig. 7.—The Cabbage Aphis: 1 and 2, male; 3 and 4, wingless female—2 and 4 enlarged.

British Columbia, Ontario, Nova Scotia and Prince Edward Island. The worst attacks were probably in Prince Edward Island and Nova Scotia, whence frequent requests for information came. The injuries were to both cabbages and turnips. When cabbages in gardens are attacked, the insect should be looked for when the plants are being cultivated, and, as soon as the first colonies appear, which will probably be late in July or in August, they should be attended to at once, before they increase in numbers. Whale-oil soap, one pound in six gallons of water, or the ordinary 1 to 9 dilution of kerosene emulsion, if sprayed thoroughly, will destroy the aphid. In turnip fields, where by far the greatest amount of injury is done, those engaged in thinning and hoeing should be constantly on the watch for infested plants, which may at that time be hoed out and destroyed. This will, in many instances, be sufficient to prevent the occurrence later of a serious outbreak. The eggs of this insect are laid on the turnip tops late in autumn. This suggests the

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advisability of ploughing down deeply all tops which are cut from the roots at the time of harvesting in autumn, so as to destroy the eggs. In fields of cabbages, where also eggs are laid, the same practice should prevail when the cabbages cannot be fed or are too poor to store for feed purposes. The leaving of poor or imperfectly developed crops in the field until the following spring is always a dangerous practice from the point of view of those who study insect attacks. Not only may the crop have been reduced to its worthless condition by the attacks of insects which will pass the winter safely among the plants; but, even on well developed plants, there are always certain natural enemies the presence of which is detrimental to the farmer and gardener. Whenever possible, all haulms, vines, stems and foliage should be fed to stock; but, in the few cases where these are useless, they should be ploughed down into the soil to decay or be burnt, and, when this can be done in autumn, it is far better than waiting till the following spring. Many insects and fungous diseases are thus destroyed or placed where they can do no harm, and much time is saved in spring in having the land in a condition to start work at once.

**CUTWORMS.**—These troublesome caterpillars have, as is usually the case, been more or less destructive to field and garden crops everywhere; but in Nova Scotia and Prince Edward Island almost every report mentions their depredations, and the official crop reports from these provinces show that considerable harm was done in almost every county. Such specimens as were received at the Division were the Red-backed Cutworm (*Paragrotis ochrogaster*, Gn.). The same species was the one responsible for most of the harm done in Quebec, Ontario and Manitoba. In Ontario it was accompanied by the Dark-sided Cutworm (*Paragrotis messoria*, Harr.), which was enormously abundant in some places at Ottawa. Here also in restricted localities the so-called Climbing Cutworm (*Paragrotis scandens*, Riley) was troublesome in sandy fields. At Regina and Calgary, N.W.T., the species which did harm in gardens was *Chorizagrotis auxiliaris*, Grt., the large caterpillars of which resemble the Red-backed Outworm in a general way, and are equally omnivorous, destroying all kinds of succulent plants. The moths of *C. auxiliaris*, Grt., as well as of the allied *C. introferens*, Grt., and *C. agrestis*, Grt., both of which, possibly, are only varieties of *C. auxiliaris*, Grt., have been taken in large numbers at Millarville, 20 miles south of Calgary, by Mr. F. H. Wolley-Dod, and by Mr. T. N. Willing, at various places north and south of Regina. In Vancouver Island the species which was most troublesome proved to be *Paragrotis*

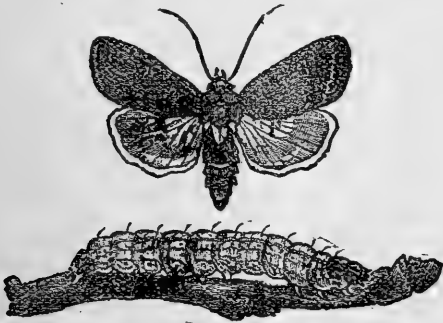


Fig. 8.—The Climbing Cutworm : moth and caterpillar.

*perexcellens*, Grt., which was very much commoner than it had been for some years. In 1885 it was a perfect plague in market gardens around Victoria, and in 1888 specimens were also sent to me, which were at that time incorrectly identified and mentioned in my report for 1888 as an allied species, under the name of *Agrotis obeliscoides*, Gn.

All of the species mentioned above have the same feeding habits and would be controlled by the same measures, which are: The removal from gardens or fields, as early as possible in the autumn after crops are reaped of all refuse, and the cultivation of the land so as to prevent the deposition of eggs. This takes place during August and September, and some of the eggs, if not all of them, remain unhatched until the following spring; therefore, late fall ploughing, or early spring ploughing, by which the eggs were buried deeply would be beneficial. When in large numbers, these caterpillars, like most other cutworms, wander long distances at night in search of food. Therefore, it is necessary to make some direct application

to destroy them. For this purpose, the best remedy in my experience is the poisoned bran mash, which is remarkably efficacious. In making this material, which is equally useful in field practice as in gardens, it is best to dampen some of the bran slightly with water containing a little sugar. After mixing thoroughly, add the Paris green little by little, stirring all the time. If Paris green is added to the bran when it is perfectly dry, it will, owing to its weight, sink at once to the bottom when stirred. Half a pound of Paris green is sufficient to poison 50 lbs. of bran, although double this amount may be used. Bran should be added to the mixture until it will crumble easily and run through the fingers without adhering. It may then be distributed through or along the edge of an infested crop or may be applied to land either around or between plants, or a row may be run close to drills by means of a Planet Jr. seeder, or a similar implement. For such crops as tomatoes, cabbages, tobacco, &c., a collar of paper put around the stem at the time of planting, will prevent the destruction of many plants. Seedlings must be planted so that none of the leaves hang down and touch the ground. The same protection is provided in a more permanent manner, but at greater cost, with strips of tin. Convenient rings may be made from old tomato and fruit cans by throwing these into a bonfire and melting off the tops and bottoms and then splitting the sheet of tin which is left down the centre. This not only makes a good protection against cutworms, but disposes of a class of rubbish which often accumulates to an inconvenient degree.

The SUGAR-BEET WEBWORM (*Loxostege sticticalis*, L.).—When in Manitoba last

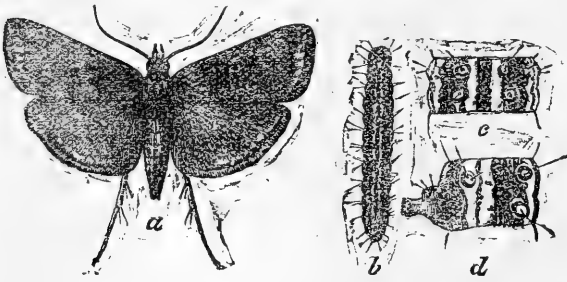


Fig. 9.—The Sugar-beet Webworm :  
a, moth ; b, caterpillar ; c, d, segment of b—  
all enlarged.

(Chittenden, U. S. Dept. of Agriculture.)

July, my attention was drawn by Mr. Hugh McKellar to reports which appeared in the newspapers of swarms of a small blackish caterpillar which had appeared at Brandon and other points east and west of that city, and which after devouring its natural food plants, had wandered in armies to new fields in search of food. The first notice of this insect in 1903, came to me from Mr. J. R. McMullen, of Melita, Man., who stated that two years before this he had noticed enormous numbers of small moths among his wheat in the month of June. He writes on June 15, in a letter addressed to the Department of Agriculture for Manitoba, which was referred to me, an interesting account of an excessive occurrence of the caterpillars during 1902, as follows: 'I thought no more of these moths until last summer. I had ploughed a field of stubble in June and sowed it in Brome grass, of which I got a good catch. There was a lot of pigweed in it, and, when the weeds were about four or five inches high, I was surprised to see thousands, yes millions of worms, eating up the pigweed, making a complete job and killing it entirely. On thirty acres they ate every pigweed, but very little of the grass or any other plants. They started to work on the north side of the field and travelled south. Nothing would turn them. When they came to the tub where the horses are watered, they crawled up the sides and fell into the water by thousands; even when they came to the house, they crawled up the walls and clean over the house. These caterpillars were from three-quarters of an inch to an inch long, greenish in colour and with yellow stripes down the back and sides for the full length of their bodies. On the back the stripes were widened out or dotted in ten or a dozen places. When they reached the garden, they ate nothing except beets, although they tasted some other vegetables but did not eat much of them. They came to a big field of wheat just headed out, but did it no harm. In four or five days they were all

When in Manitoba last July, my attention was drawn by Mr. Hugh McKellar to reports which appeared in the newspapers of swarms of a small blackish caterpillar which had appeared at Brandon and other points east and west of that city, and which after devouring its natural food plants, had wandered in armies to new fields in search of food. The first notice of this insect in 1903, came to me from Mr. J. R. McMullen, of Melita, Man.,

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gone. I did not notice any of the moths last year, but now (June 15), the moths are thick, and I send you a few to examine. I should like to know what these are, although they did me no harm last year; in fact, they saved me a day or two's work cutting weeds, but I might not have a field of pigweed ready for them when they come again.'

The Sugar-beet Webworm can hardly be described as a green caterpillar, because it is dark black, with greenish yellow stripes, but, strange to say, almost every correspondent who mentioned it referred to it as a green caterpillar. As, however, in most instances specimens of the caterpillars accompanied the inquiries, there was no doubt as to the identity of the species, which has been kindly supplied to me by Dr. Dyar, of the Division of Entomology, at Washington. It would appear from the dates when caterpillars are mentioned by observers in Manitoba, that there were two broods of this insect last summer. The life history of the species has been carefully worked out by the Division of Entomology at Washington, and illustrated articles have appeared upon it in 'Insect Life,' V. and VI., and in the recent Bulletin 43, by Mr. F. H. Chittenden, on the 'Principal Insect Enemies of the Sugar-beet.' The excellent illustrations given herewith have been kindly lent to me by Dr. Howard and were used in the last named bulletin.

The following letter gives some idea of the range of plants liable to be attacked by these caterpillars. There is no doubt that the normal food plant is the Lamb's-quarters or Wild Spinach (*Chenopodium album*, L.), often called pigweed.

'Deleau, Man., July 21.—We have had a visitation from a pest that I have never seen before in my 21 years' residence here. About two weeks ago we noticed the pigweed on land left for summer-fallowing covered with a greenish worm, samples of which I send you. In a day or two these swarmed into the garden in millions. They scarcely touched potatoes, beans or corn, but devoured turnips, beets, cabbages, onions, carrots, currant bushes, and even crap-apple leaves. We made a vigorous fight to save something, making narrow trenches for them to fall into, and tried various poisons, but without avail; so, we stuck systematically to knocking them into tin pans and emptying these into pails of water with coal oil in them. In this way we caught several pailfuls in a day. They have now almost disappeared but have left the garden in a very dilapidated condition. As soon as we noticed them coming off summer-fallow, we ploughed the land next to our garden, but they swarmed over on top of the ploughing. They seem to be good travellers. I should like to know what they are.'

—J. E. MARPLES.

Specimens of the caterpillars were sent, without any letter being received, from Mr. H. L. Patmore, of Brandon.

Mr. Norman Criddle, of Aweme, sends the following notes :

'Sept. 5.—Do you remember mentioning when here a small prairie moth, which one of your correspondents was afraid of as a possible enemy of wheat. I am sending you now what I am pretty sure are the larvæ of the moths you showed me. These caterpillars are here now simply in enormous numbers, more so than anything of the sort I have ever seen. They clear off all the food before them and then march on in a regular swarm, all going the same way. The food plant seems to be usually lamb's-quarters, but this has been all eaten clean, and they are now turning their attention to wild buckwheat, the native asters, the tumble-weed (*Amarantus*), sand cherry, red cherry, rose, red-root pigweed, and even wheat and oats, as well as numerous other plants. Fortunately, they are too late in the season to do much harm, and in any case they seem to prefer weeds to grain. The moths were very abundant during June and July.'

'Sept. 27.—The larvæ have now all disappeared beneath the ground, but whether to hibernate or pupate, I am not quite sure. Several that I dug out had not yet undergone any change, but had merely made a straight burrow about two inches deep, which

they had lined somewhat loosely with web. In reply to your letter, the food preferred to all others is lamb's-quarters, and wheat was only attacked when all other plants had been eaten. So far, instead of this insect being an enemy, the caterpillars have proved undoubted friends.'

'Oct. 18.—I went out this morning to try and find out for you whether the larvæ of *Loxostege sticticalis*, L., had turned to pupæ or not. I found they were all hibernating as larvæ, as you suspected. They are from one to two inches beneath the ground in a closely woven chamber of web, and they are now very sluggish.'

The Sugar-beet Webworm is stated by Mr. Chittenden in his bulletin, to be an introduced insect from western and central Europe and northern Asia, which is evidently slowly but steadily pushing its way eastward. From the letters given above, it is quite apparent that the outbreak of last summer was exceptional, and also that the favourite food plant is the well known and troublesome weed of western wheat fields, the lamb's-quarters, and allied plants. As, however, the sugar-beet is one of these and great efforts are being made in the West to foster the cultivation of this crop, it seems important to make the appearance and habits of this insect well known. The most important points with regard to these are as follows: The pale yellow eggs are laid singly or in rows of two to five, overlapping like fish scales. The young larvæ are at first whitish, with polished black heads and bristle-bearing spots. They soon become blackish caterpillars with thin skins, through which the green contents of the body show. These are very voracious and very soon strip plants of their leaves. The caterpillars appear in July and early September. Pupation takes place in the ground, not deeper than two inches beneath the surface, consequently they can be reached and disturbed by the teeth of an ordinary cultivator at the time they are in the delicate chrysalis condition. Actual experiments are reported by Dr. Howard (*Insect Life*, VI., p. 37) to have been successful with the winter brood. It would doubtless be so with the summer brood. Prompt attention in spraying an infested crop with arsenical poisons will certainly control this insect should it ever become troublesome in crops of sugar beets. Such plants as spinach in gardens could not, of course, be treated with poison. In those cases, mechanical means of prevention as ditching, might be tried.

## FRUIT CROPS.

A satisfactory feature of the year 1903, like that of the previous year, has been a marked decrease in the injuries caused by some of the well known pests of the fruit-grower. The Tent Caterpillars, Cankerworms, Squash Bugs, and even the Codling Moth, in most places may be said to have done hardly any harm. Fruit crops have been exceptionally remunerative. The apple crop in Nova Scotia was a remarkably good one, large in quantity and excellent in quality, being very free from insect attacks as well as from Black Spot and other fungous diseases. (B. W. Chipman.) In Prince Edward Island the crop was 'rather poor, having been injured by the late frosts and dry weather in spring.' (E. J. McMillan.) Through Quebec and Ontario the crop on the trees was not so large as in some previous years, but the quality was so exceptionally good that there was a larger quantity of A 1 fruit for export than has been the case for several years. Only in the west of Ontario was any trouble experienced with Black Spot fungus, or insect enemies. In British Columbia apple crops were somewhat reduced by the attacks of the Apple Aphis, but the output was large and of excellent quality. The poor crop of apples in England last season gave Canadian growers a good opportunity of showing to what exceptional excellence this valuable fruit can be grown in this country, and the large quantity shipped up to the end of November, over 1,000,000 barrels, with a probable total export of 2,000,000 by the

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end of the season, as well as the high quality of the fruit, will no doubt make a lasting impression on the British market.\*

'There was a fair yield of apples; but in various parts of the province of Ontario complaints were made of the scarcity of barrels, and, on this account, buyers were more particular than ever in the selection of this fruit; thousands of bushels of apples that in former years would have passed for shipment to Great Britain, were this season rejected by them.'—(C. C. James).

Not only was the quality of the fruit exported this year better for the above reason, but the rigorous application of the 'Fruit Marks Act' has prevented much second-rate fruit from going forward, which otherwise would have found its way to the British markets. This will be a decided and lasting benefit to the country. Grapes were a good crop in the Niagara peninsula, but in Essex and Kent the crop was practically destroyed by the Black Rot of the Grape (*Loestadia Bidwelli*, V. & R.) Plums were an enormous crop in almost all parts of the Dominion, injuries by the Plum Curculio being considered this year rather a benefit than otherwise for the work they did in thinning fruit on the overloaded trees. The only discounted reports as to plums were from some parts of the maritime provinces. In British Columbia considerable loss occurred from the attacks of the fungous disease known as Brown Rot or Ripe Rot (*Monilia fructigena*), which attacks the fruit just when it is ready for the market. This loss was chiefly on Vancouver Island and near the coast on the mainland. Orchards which had been sprayed early in spring and where the diseased plums had been carefully gathered and destroyed, were noticeably freer from attack than where no remedial measures had been adopted. The Shot-hole Fungus (*Cylindrosporium padi*) also did considerable injury by defoliating the trees before the fruit was ripe. This, like the last named disease, can be controlled by regular spraying. Peaches were an enormous crop of excellent quality. Cherries were fair on Prince Edward Island, good in New Brunswick and Nova Scotia, excellent and abundant in Quebec, Ontario and British Columbia. The pear crop is reported as good; but the ravages of the Pear-tree Slug were serious in some places, and the Pear-tree Flea-louse is reported by Prof. Lochhead as having been very injurious in the Grimsby district of Ontario. On the fruit farm of Mr. W. R. Dewar, trees were much stunted and were covered with the dirty black fungus, *Fumago salicina*, which develops upon the honeydew emitted by this insect and various other kinds of plant-lice. Berries and small fruits generally were seriously affected by the drought of early summer through the region where this prevailed. The rains, which came about the middle of June, were too late to save the strawberry crop but helped considerably raspberries and currants. Cranberries in Nova Scotia did not produce such a paying crop as usual, but this was not due to any trouble with insect enemies. In Prince Edward Island this crop was reported as 'fair.'

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\* The following extract from the 'Glasgow Herald' of January 5, 1904, in an article upon the Fruit Imports into the United Kingdom in 1903 is significant: 'Green Fruit Import. The apple trade was unique, 1903 being a bumper year. The total weight was 4,550,000 cwt. valued at £2,850,000. In ten years the imports have been nearly doubled; 1903 even surpassed 1896, which was the most prolific season of recent years. The imports in favour of 1903 against 1896 are 3,000,000 bushels. We get the largest parcels from the United States and Canada. These countries send us more than 2,500,000 cwt. annually. Of course, the Canadian apples are much superior to those of the United States.'



OYSTER-SHELL BARK-LOUSE (*Mytilaspis ulmi*, L.—*M. pomorum*, Bouché) has been complained of from almost every part of the Dominion where fruit trees are grown; and the chief reason that it remains unchecked and continues to increase, seems to be that it is so often overlooked by fruit growers and others who ought to know such a common and destructive enemy by sight and also be well acquainted with the best means of fighting against it. In south-western Ontario excellent work has been done in preventing the spread of this scale by the minute chalcid parasite, *Aphelinus mytilaspidis*, Le-Baron. The presence of the parasite in a district can be detected by the minute round holes left by the tiny parasites where they have eaten their way out through the tops of the old scales. This minute friend is so small that it can hardly be seen with the unaided eye. It is bright yellow in colour, with golden eyes, and measures only about one thirty-sixth of an inch in length. Under a magnifying glass, it is found to be a four-winged fly shaped as shown in the enlarged figure herewith. This parasite is sometimes so abundant that it destroys more than half of the scales which are formed. It has occurred in all parts of Canada but never seems to remain long in any district, a fact which is rather remarkable, as the Oyster-shell Bark-louse upon which it feeds is abundant everywhere. For the last year or two it has been noticed in large numbers upon scale-infested fruit trees in the Niagara district. There is only one brood of the Oyster-shell Bark-louse in the year. The young bark-



Fig. 10.—Twig infested with Oyster-shell Bark-louse.

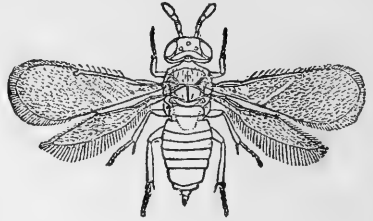


Fig. 11.—*Aphelinus mytilaspidis*.

lice emerge from beneath the old scale in Ontario and British Columbia about the end of May, and in the maritime provinces towards the end of June. At that time they are small six-legged insects resembling mites. After emerging, they wander about the trees for a few hours, looking for a suitable place to attach themselves to the bark, which they do by means of their slender beaks. Once having attached themselves, they never move from that place; gradually their legs disappear, with the increase in size of their bodies, and a waxy scale is secreted over them. By the middle of August the female bark-louse has practically changed into a bag of eggs protected by a scale. Little by little the body of the mother insect dries up; and, when all of her eggs are laid, the scale is well filled with these minute white objects, and the mother's body is merely an empty skin at the small end of the scale. The scales of the male bark-lice are seldom noticed. They are of different shape and, as a rule, occur on the leaves. They are much smaller than those of the female and are long, narrow and white. (Fig. 12c.) The perfect male is a tiny winged insect which is able to fly well.

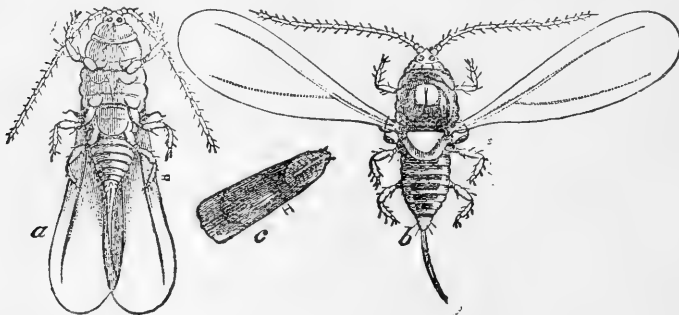


Fig. 12.—The Oyster-shell Bark-louse: a, b, male adult; c, male scale—much enlarged.

Trees upon which this insect occurs, are weakened by being robbed of their sap by these small insects, which frequently occur in such enormous numbers as

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almost to coat the trees and entirely hide the bark. Although so destructive in all parts of Canada, the Oyster-shell Bark-louse is not a particularly hard insect to control, where trees are attended to regularly. The first step to take when an orchard is found to be attacked is to invigorate the trees by ploughing round them and feeding them with some quick-acting fertilizer, such as well rotted manure, or a dressing of wood ashes. When trees have been standing in sod, it is well to break this up. Trees which are planted too closely, should be pruned and cleaned out, so that they may be easy of access for spraying and other operations. As soon as winter has set in, the trees should be sprayed thoroughly with a thin lime wash, one pound of lime in each gallon of water. Two coats must be applied, the second immediately after the first is dry. Where the lime-sulphur-and-salt wash is used to protect trees against fungus and insect enemies, there will never be any trouble with the Oyster-shell Bark-louse. The young bark-lice emerge from their mothers' scales during June; the exact date should be watched for, and, immediately the dust-like yellow mites are noticed, the trees should be sprayed without delay with weak kerosene emulsion, or a whale-oil soap solution, using one pound to six gallons of water.

The SCURFY BARK-LOUSE (*Chionaspis furfura*, Fitch).—In western Ontario this bark-louse has become so abundant recently, that many fruit growers are noticing it. In several cases, it has been mistaken for the San José scale and has been sent in for that insect. It is only occasionally that this scale develops in sufficient numbers to injure trees seriously. When it does so, it can be treated in the same way as the Oyster-shell Bark-louse. Mr. W. W. Hilborn found it was entirely destroyed by the lime-sulphur-and-salt wash. The eggs of the Scurfy Bark-louse are bright red in colour and are to be found beneath the scales by the middle of August or early in September. The male scale, as in the case of the Oyster-shell Bark-louse, is of quite a different shape from that of the female. In both sexes the scales are white and so closely appressed to the bark that they are easily overlooked or are not recognized as scale insects. The male scales are frequently found all clustered together in groups around the base of a twig or at some inequality of the bark.

The EYE-SPOTTED BUD-MOTH (*Tmetocera ocellana*, Schiff).—The insect concerning which most inquiry was received from Nova Scotia last spring, was the Eye-spotted Bud-moth. Attention had already been called to it by its frequency in Nova Scotian orchards during the previous year, and specimens also came in from some parts of Ontario and Quebec and from one point in British Columbia. Prof. F. C. Sears, Director of the Nova Scotia School of Horticulture, of Wolfville, N.S., writes at the end of the season: 'Even the Bud-moth, which for the past few seasons has been extremely abundant, proved much less troublesome than was anticipated. This was undoubtedly due in large measure to the fact that our orchardists now understand it better and apply the early spraying, by which it is best controlled. We find that this early spraying should be applied from May 1st to 10th, according to the season. I am glad to report that spraying was much more general during the past season than ever before, particularly in Annapolis County. One dealer there sold one hundred spraying outfits; but, as the season was particularly unfavourable for fungous pests and most insects, I fear that some that sprayed for the first time may be discouraged.' It was suggested by Mr. E. E. Archibald, of Wolfville, N.S., that the irregularity in the fruit crop in the celebrated Annapolis valley of Nova Scotia might be due to the depredations of this small but very destructive and frequently unrecognized enemy. I believe that his suggestion was in a large measure correct and, where correspondents had reported a blighting of the leaves and fruit buds, I am sure these results had been in many cases directly due to the attacks of the caterpillars of the Eye-spotted Bud-moth. On account of its abundance last year, it will be wise for fruit growers to examine their trees during the present winter and early next spring, to see if there are any of the

small brown caterpillars upon them, and, should they find any, to be prepared to spray their orchards thoroughly, just at the time the buds are bursting, with a poisoned Bordeaux mixture, this being the remedy,—of many which have been tried,—which has given the best results. This mixture, made according to the formula which we use at the Experimental Farm, is as follows:—

Copper sulphate (bluestone) . . . . .	4 lbs.
Unslaked lime . . . . .	4 lbs.
Paris green (for Bud-moth and other leaf-eating insects) . . . . .	8 oz.
Water (one barrel) . . . . .	40 gals.

Dissolve the copper sulphate by suspending it inside a cotton bag in a wooden or earthen vessel containing five or more gallons of water. Slake the lime in another vessel, and then strain the lime wash through coarse sacking or a fine sieve. Pour the copper sulphate solution into a barrel, or it may be dissolved in this in the first place, and fill the barrel with water. Stir thoroughly before using. A stock solution of copper sulphate, and lime wash may be prepared and kept in separate covered barrels through the spraying season; but the quantities of copper sulphate and lime in the solutions should be carefully noted, so that the proper strength may be used when a wash is required for spraying.

The caterpillars of the Eye-spotted Bud-moth pass the winter on the twigs of trees, upon the foliage of which the eggs had been laid the previous summer. Each caterpillar is snugly curled up inside a small silken tent or covering called a pseudo-cocoon. These are extremely difficult to find until their appearance is known. They are located, as a rule, right in the crotch between two twigs, or in any small depression on a fruit spur. In many instances, I have found that a small piece of leaf or of lichen, is attached to the outside. On opening these with the tip of a knife, the small brown black-headed caterpillar, one-eighth of an inch in length, will be found inside. These caterpillars when they go into winter quarters are less than half-grown, having passed through three or four of their six moults. Early in spring, just before the time that the leaf buds burst, they emerge from their shelters and attack the opening leaf and flower buds. They do a great deal of harm at this time because they not only devour the young leaves but a single caterpillar will destroy a whole cluster of flowers. Their injuries are severe, both upon young trees and also upon full-grown bearing trees, which in some instances have been stripped of almost every bunch of flowers. These caterpillars become full-grown during June and then spin cocoons among the dead leaves which they have injured. The small gray and white moths appear during the month of July. These moths are similar in shape and size to the Codling Moth but are of a general dark gray colour, blotched with white, which makes them very inconspicuous when they are at rest on the trunks of trees. They measure about three-fifths of an inch across the opened wings and may be recognized by an eye-like spot upon each of the fore wings. The moths appear from June to the middle of July; they rest on the trees during the day time but are very active at night, flying about fruit trees and laying their eggs upon the leaves. The eggs are remarkable little objects which lie very flat upon the leaf on which they are deposited. Under a magnifying glass, they have more the appearance of minute drops of water, or of tiny fishes' scales than of the eggs of an insect. Ten days after the eggs are laid, the young caterpillars hatch, and their habits during the summer are quite different from those of the spring. As soon as the caterpillars hatch, they crawl to the middle of the lower side of the leaf and form a silken tube close to the midrib of one of the larger veins. Here they feed upon the tissues of the lower side of the leaf, leaving the network of veins and the upper surface of the leaf. As they extend their operations, they cover themselves with a light tent of silk. They grow slowly, remaining for eight or ten weeks on the same leaf where they were born; they then stop feeding and crawl from the leaves to a con-

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venient place on the twigs, where they spin their winter coverings. This generally takes place, Professor Slingerland found, in the first half of September, and is done irrespective of the weather, even if it be fine and hot, and there is abundance of food. Like all other insects, they seem to know instinctively that it is the proper time for them to prepare for winter. The spring appearance of the caterpillars, on the other hand, is much less regular as to date and will vary as much as three or four weeks, according as the spring and the time of the opening of the buds is early or late. However, it may be generally stated that the caterpillars leave their winter quarters and begin their depredations at the time the leaf buds open. There is only one brood of this insect in the year, the caterpillars which attack the leaves in the late summer, being the same ones which destroy the leaf buds the following spring. The moths appear at only one period in the year, viz., during the three or four weeks from the middle of June till the middle of July. Since the life-history of this insect has been discovered, better remedial measures have been devised than were previously known. The fact that the caterpillar passes the winter half-grown, accounts for the large amount of injury which is done so soon after growth begins in spring. The Eye-spotted Bud-moth attacks, besides the apple, the plum, the peach, the pear, the quince and the blackberry.

The remedy which, as stated above, has given the best results, is to spray the trees thoroughly with a Bordeaux and Paris green mixture at the time the buds are opening, covering the whole tree so that every bud may receive its share of poison. The Bordeaux mixture will also, when applied at that time, materially hold in check the troublesome Black Spot disease of the apple. There are, of course, many other kinds of poisons which may be used ; but those which have given the best results, are Paris green, Arsenate of Lead or Disparene, and Green and Pink Arsenoid. Where great care is exercised in mixing and making the application according to instructions and also in destroying carefully all surplus left on hand after spraying, white arsenic in any of its combinations may be used and will destroy all leaf-eating insects, upon trees which have been sprayed with a mixture containing it ; but its use is attended with considerable danger to foliage and also with great risk to animal life, including human beings, from having about a house or outbuilding a substance which so closely resembles so many materials used in a household. In Prof. Bailey's most useful little Horticulturists' Rule Book, under the head of arsenic, we find the following:—'Arsenic.—Known to chemists as arsenious acid or white oxide of arsenic. It is considered an unsafe insecticide, as its colour allows it to be mistaken for other substances; but in its various compounds it forms one of our best insecticides. From one to two grains, or less, usually prove fatal to an adult; 30 grains will usually kill a horse, ten grains a cow, and one grain, or less, is usually fatal to a dog. In cases of poisoning, while awaiting a physician, give emetics ; and, after free vomiting, milk and eggs. Sugar and magnesia in milk is useful. In the very complete experiments which have been recently carried out under the instructions of Dr. L. O. Howard, the United States Entomologist, by Mr. C. B. Simpson, on the Codling Moth, the following important statement is made as to the insecticide which he found most useful in his extensive investigations:—

*'Arsenite of Lime with Soda.*

White arsenic . . . . .	pound	1
Sal soda (crystal) . . . . .	pounds	4
Water . . . . .	gallon	1

'The ingredients are boiled in the required amount of water until dissolved, which will take place in a comparatively few minutes, after which the water lost by evaporation is replaced. To every 40 or 50 gallons of water a pint of this stock solution and from 2 to 4 pounds of fresh slaked lime are added. The chemical com-

pound derived from the combination of the sal soda and the white arsenic is arsenite of soda. In the presence of lime this breaks down and arsenite of lime is formed. It requires 4.4 pounds of crystal sal soda, or 1.6 pounds of dry sal soda to combine with one pound of arsenic, and 2 pounds of freshly slaked lime to combine with one pound of arsenic to form arsenite of lime. It is always desirable to have an excess of lime present, in order to prevent all danger of burning; furthermore this excess is a convenience to fruit growers, because they can see by the distribution and amount of lime on the foliage how well the spraying has been done. The formula, which is the Kedzie formula with a few minor changes, has been used in many different sections of the country with unvarying success. In all of the practical tests under the advice of the writer, this solution is used and is found to be, not only as efficient as other solutions, but far cheaper.

‘When it is desired to use Bordeaux mixture with this solution, it is added to the Bordeaux mixture in the same proportion as to a similar quantity of water.’

The above quotation is given here because I am aware that many fruit growers in different parts of Canada are using white arsenic in some form for spraying fruit trees in preference to Paris green, and moreover because considerable injury has followed this practice, which has to a certain measure served to discredit the most important practice of spraying fruit trees for the prevention of injury by leaf-eating insects. In my own experience, I prefer to use Paris green, knowing it to be perfectly effective and believing that, notwithstanding the fact that it is a little more expensive than some other arsenical insecticides, it yet repays enormously any expenditure by the improved condition of sprayed trees; but, if other substances are used, probably the Kedzie mixture is the best. Disparene, or arsenate of lead, is also another very valuable insecticide, one great feature in its favour being the length of time it remains effective on the foliage. Mr. Joseph Tweddle, of Fruitland, Ont., who not only himself grows very satisfactory crops in orchards which he has sprayed, but has also done much work in spraying orchards for other fruit growers, who have been well satisfied with the treatment used by Mr. Tweddle, tells me that the spray which he uses is made as follows:—‘I boil half a pound of white arsenic in one gallon of water with one pound of lime for 45 minutes, and make up to the original quantity of water when it is finished boiling. I use this in 50 gallons of Bordeaux mixture for apple and pear trees, except for the third or fourth treatment when it will sometimes burn the foliage if used at this strength. I have never used it on plums and cherries at the above strength without doing some injury, and would always advise care in spraying so as not to drench the trees. I find this mixture very effective against all leaf-eating insects. When spraying peach trees for *Curculio* I use this mixture of half the strength without the Bordeaux mixture, and when with the latter not more than one quarter strength.’

Prof. C. P. Gillette, of Colorado, recommends a somewhat simpler method of preparing arsenate of lime, which is to boil for three-quarters of an hour one pound of white arsenic and two pounds of fresh lime in one gallon of water, and of this he uses one quart to an ordinary barrel of 40 gallons. Prof. Gillette also draws particular attention to the necessity of using fresh lump lime and of exercising the greatest care in labelling everything containing this mixture plainly ‘Poison.’

The proportions in which I have found the best known arsenical poisons satisfactory, are as follows :

Paris green—1 pound to 160 gallons of water, with 1 pound fresh lime.

Arsenate of lead—1½ pounds to 50 gallons of water.

Green arsenoid—1 pound to 160 gallons water, with 1 pound fresh lime.

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The APPLE-LEAF SEWER [*Ancyliis (Phoxopteris) nubeculana*, Clem.]—Apple orchards at Fruitland, Grimsby, St. Catharines and Niagara-on-the Lake, were to a moderate extent infested last autumn by the small caterpillars of this insect. The sewed leaves were conspicuous on the trees in autumn. Inside these

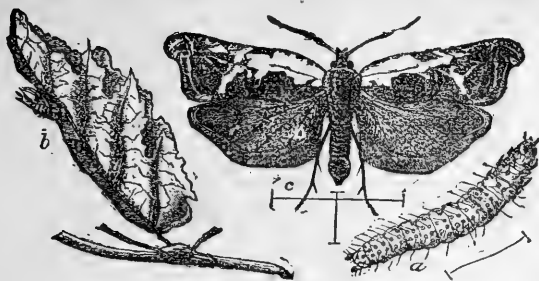


Fig. 13.—The Apple Leaf-sewer: a, caterpillar; b, pupa case on leaf; c, moth—a and c enlarged.

leaves, which fall to the ground, the caterpillars remain until the following spring, when they change to chrysalids; and the pretty moths, which are shown at fig. 13, appear in May and June. The chrysalis works its way through the leaf, and, when the moth escapes, the empty skin remains attached to the leaf. This insect has never been a serious pest to the apple grower, and is only sometimes sufficiently abundant to attract notice. The only remedy which has been recommended, is to rake up the leaves in the autumn and burn them.

The APPLE-LEAF MINER (*Tischeria malifoliella*, Clem.)—Rather more abundant than the above and more destructive was this small leaf-miner. It occurred in several orchards near Grimsby, and Mr. Joseph Tweddle reports it as being sufficiently abundant to require attention. It has been noticed more or less in this same district for several years, specimens having been sent once or twice by Mr. Geo. E. Fisher, of Freeman, Ont., who had noticed it in orchards and nurseries in the above named district, when inspecting for San José scale. I do not think that it is ever likely to develop into a serious enemy, but it is advisable for students of insects to find out a little more than is at present known concerning its exact life history, so that, in case it ever requires special treatment, we may be prepared with a practical remedy, which as yet is wanting. The only remedy now suggested is to burn the fallen leaves in infested orchards, either in autumn or before the moths leave them in the spring.

The APPLE APHIS (*Aphis mali*, Fab.)—Plant-lice of all kinds have been noticeably abundant on many crops throughout Canada and the northern United States during 1903. Although this has been the case, it cannot be said that their injuries

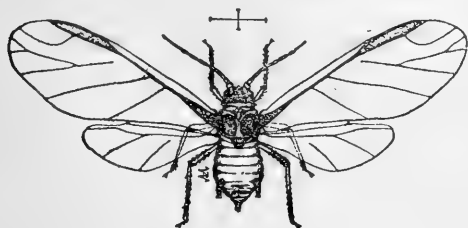


Fig. 14.—The Apple Aphis—enlarged.

have been excessive, for in nearly every instance, they were attended by large numbers of their natural parasites, which soon reduced the numbers so much that they were unable to do appreciable harm. The only injuries which could be considered serious, were where the insects attacked young stock in nurseries and fruits while young. Some of our large nurserymen in western Ontario inform me that Apple Aphis did them considerable harm last season, particularly upon budding stock, late in July and in August. In Prince Edward Island and in British Columbia, an injury which I have already alluded to as caused by the Apple Aphis, was again this year apparent on apples. This injury is of a serious nature, and takes the form of deep pits which are left on the growing fruit at spots where apples have been punctured by the aphid when they were small. This gives the fruit a distorted, gnarled appearance which renders it quite unsaleable.\* As a general thing, except in British Columbia, it is not advisable to go to the expense of spraying bearing apple trees for destroying the Apple Aphis. The insects are most abundant when they first hatch from

\*See Fig. 15, next page.

the eggs, in which form they pass the winter. At that time the plant-lice cluster on the buds to such an extent as to almost hide them. With the rapid expansion of the foliage, they are soon lost sight of, and it is very seldom that serious injury results from their presence. Late in the autumn, when they come back again to apple trees after passing some time on grasses and fall wheat, they are again found in large numbers upon apple trees, where they lay their eggs. In British Columbia, this insect is one of the most destructive orchard pests the fruit-grower has to deal with, and treatment of infested trees is frequently a necessity.

It may also be noted that, although the Apple Aphis was troublesome last season in many parts of the Pacific province, Mr. Venables expressly states that the Apple Aphis was less abundant than usual at Vernon, although one might have expected it to have appeared in great force, judging from the large number of eggs laid in 1902. These, however, for the most part failed to hatch last spring. The Apple Aphis is a green plant-louse, having the head, the eyes and the thorax black. The head is pointed in front, and the prothorax has lateral tubercles. The antennæ are shorter than the body. On comparing this species with the Grain Aphis, which very much resembles it, the most striking differences are that in the latter species the eyes are reddish, the head and thorax brown and the head not pointed in front. The antennæ, which are a little longer than the body, are also borne on distinct frontal prominences. A remedy which answers well for the Apple Aphis, is to spray the infested trees thoroughly with whale-oil soap, one pound in six gallons of water, or with a tobacco and soap wash made by soaking ten pounds of tobacco leaves in hot water for a few hours, then straining off the liquid and adding two pounds of whale-oil soap. Stir until all is dissolved and fill up to make 40 gallons. If this wash is applied as a spray two or three times at short intervals, little difficulty will be met with in destroying the Apple Aphis.

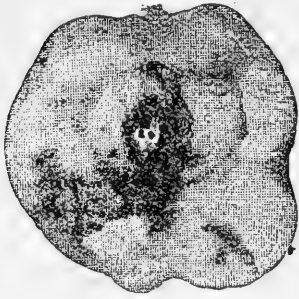


Fig. 15.—Section of Apple showing distortion of outline.

The injury to apples referred to above resembles very closely that of the small British Columbia Apple-fruit Miner (*Argyresthia conjugella*, Z.), as shown at fig. 15.

The PLUM APHIS (*Aphis prunifolii*, Fitch) was mentioned by correspondents several times during June, and trees infested were sprayed promptly with whale-oil soap or the tobacco and soap wash with good effect. In British Columbia an allied species, *Hyalopterus pruni*, Fab., was reported by Mr. E. P. Venables, of Vernon, B.C., as being in greater numbers than for several years past. The insect was also observed at several other places in British Columbia, both on the mainland and in Vancouver Island.

The CHERRY APHIS (*Myzus cerasi*, Fab.).—This is a black plant-louse, which frequently appears in large numbers early in spring and clusters around the young fruit and along the stems of the fruit and leaves, sucking the sap and doing much harm. The eggs are laid upon the twigs during the autumn, the young plant lice not hatching until the following spring. This plant-louse has done a considerable amount of harm in western Ontario for several years, and during the past summer, although in most places it disappeared early in June, in others much loss resulted from its attacks. Mr. J. B. Fairbairn writing from Bowmanville, Ont., says: 'I have two English cherry trees that for years have had their crop ruined by this pest; two seasons ago I planted out three Montmorencys, and I find they also are covered with these insects. It seems almost impossible to destroy them without injuring the trees.' The Cherry Aphis is one of the class known as Black Plant-lice, and it is a remarkable fact which has not been accounted for, that all of these dark coloured plant-lice are much harder to kill than those which are of a green or light colour. For the Apple Aphis, Hop Aphis and other green-coloured species, one pound of whale-oil soap in 8 or 10 gallons of water is suf-



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ficiently strong to destroy them; but, for the black species, I have found that six gallons of water to one pound of soap is the greatest dilution which can be used. An important point, too, in fighting this insect, is early work, because, as the egg is upon twigs all through the winter, and the young hatch there in spring, they are easily reached with a small amount of spraying material, and early treatments before the leaves have expanded, have been found most effective. The kerosene emulsion may also be used with great success at any time after the weather becomes warm in spring, and before the leaves expand. For this purpose, the stock emulsion should only be diluted with six parts of water, instead of nine, as in the usual dilution for use upon foliage.

The RED-HUMPED APPLE-TREE CATERPILLAR (*Schizura concinna*, S. & A.).—These voracious caterpillars were sent in from Nova Scotia, Quebec and Ontario, and were reported from British Columbia. Altogether, the species seems to have been rather more abundant than usual. The appearance of these caterpillars is well shown at fig. 16. The colours are as follows:—Head bright red, as is also a conspicuous hump on the fourth segment. The sides are striped with black, yellow and white lines. The blunt spines on the back are black. When

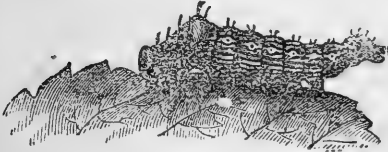


Fig. 16.—The Red-humped Apple-tree caterpillar.

at rest, the end of the body is raised and has, when viewed sideways, somewhat the shape of a dog's head. When full grown in autumn, they are a little more than an inch long. They then spin close parchment-like cocoons among the leaves on the ground, or a short distance beneath the surface, in which they remain unchanged until the following spring, when they assume the chrysalis condition, and the moths emerge towards the end of June. These are plainly coloured but prettily marked in varying shades of brown, which make them very inconspicuous when at rest, and, although the caterpillar is common, the moths are very seldom seen. These, when the wings are opened, expand from an inch to an inch and a half, the males, as a rule, being much smaller than the females. The eggs are deposited in clusters on the leaves of apple trees and occasionally on a few other kinds of trees, as willow, birch and oak. They are laid early in July, and by the end of that month the colonies of young caterpillars become conspicuous from the thorough way in which they strip whole branches of their leaves. At this time much good may be done by cutting off the branches and destroying the whole colony at once, as they very seldom wander far from each other, and when at rest, are massed together so as to hide the twigs and stem of the branch. The Red-humped Apple-tree Caterpillar has never appeared in Canada in sufficient numbers to be the cause of much loss to fruit growers, and, where trees are regularly sprayed with insecticides, this will never be the case. The species is much rarer in British Columbia than in the East, but I have on several occasions seen colonies upon wild willows, as well as upon apple trees in orchards. Mr. E. P. Venables reports it as more abundant than usual in 1903 at Vernon in the Okanagan valley. Prof. F. C. Sears sent specimens from Wolfville, N.S., Mr. P. E. Choquette, from St. Jerome, Que., and Mr. E. B. Yarwood, from Picton, Ont. A few colonies were also found at Ottawa.

The PEAR-TREE SLUG (*Eriocampa cerasi*, Peck).—The slimy blackish slug-like larvae were last year, as is too frequently the case with so easily controlled a pest, found very destructive in British Columbia to the foliage of pear and cherry trees. Specimens were also sent from Morrisburg, Ont., by Mr. Gordon Dill. The parent insect is a short, thick four-winged fly, about a quarter of an inch in length. It is glossy black, with pale legs, and has the habit, when an infested



Fig. 17.—The Pear-tree Slug.

tree is touched, of drawing in the legs and falling to the ground. There are two broods in a season, the flies of the first brood appearing and laying their eggs early in June. These are inserted into the tissues of the leaf, where they remain for about a fortnight before the young slugs hatch. The greatest injury is done to fruit trees during July. The larvæ are sometimes, and indeed very frequently, in such enormous numbers as to strip the green cellular tissue from the leaves to such an extent that the foliage of whole trees and even of orchards is destroyed, and the trees are left apparently covered with only dead leaves. This injury, occurring as it does when the trees require the full use of their leaves to bring the fruit to perfection, is a serious one, and its effects last over and affect the crop of the second year. A second brood of larvæ appears in August and September. These, when fully fed, fall to the ground and penetrate a short distance beneath the surface, where they remain until the following year, changing to pupæ about the middle or end of May, and the flies emerge soon afterwards. The Pear-tree Slug, which, as its latin name indicates, attacks also the Cherry-tree, is a very easy insect to control. In properly managed and sprayed orchards it can never be troublesome. Owing to the viscid secretion on the skin any dry, dusty material adheres to it and causes the insect great inconvenience; therefore, dusting trees with freshly slaked lime or even with finely sifted road dust, will have the effect of clearing trees of large numbers. Two or three applications should be made at short intervals. In hot, dry weather dusting trees either by hand or with an insect gun or other implement for the distribution of dry powders, for two days running, I have found quite satisfactory. The material used was freshly slaked lime, to which Paris green was added in the proportion of one pound to fifty, so that in case any of the larvæ, which might have been moulting, escaped, there would still be on the foliage poison to destroy them as soon as they began to feed. The most practical remedy is undoubtedly to spray trees with Paris green or some other arsenical insecticide, one pound to 160 gallons of water. This treatment will not only destroy the Pear-tree Slug but also many other kinds of leaf-eating insects.

The PEAR-TREE FLEA-LOUSE (*Psylla pyricola*, Foerster).—Although up to the present time the Pear-tree Flea-louse, called also the Pear-tree Psylla, has not been the cause

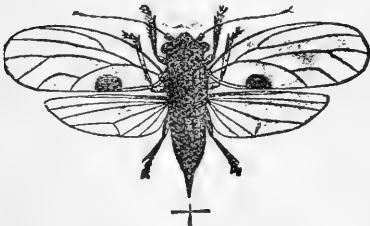


Fig. 18.—The Pear-tree Flea-louse : perfect insect—enlarged.

of widespread injury, still there are every year complaints of more or less serious loss in pear orchards in western Ontario. I have found this insect to be abundant when looked for in orchards, throughout the Niagara district and along the north shore of Lake Erie. During the last summer I have had it sent to me from two localities in Nova Scotia, and believe it to be also present at other places from which no specimens have been received. Prof. Lochhead, of the Ontario Agricultural College, writes me as follows :—

‘This insect has been very injurious this past season, more especially in the Grimsby district.’ A correspondent writes:—‘When I came home on July 4, many trees were fairly covered with it. The insects were mostly wingless, with a few winged forms. They are found in the axils of the leaves, along the petiole and along the blade, but are chiefly found on the leaves a short distance from the vein or just in the axils of the secondary veins or mid-veins. In the first place, the tissue of the leaves dries up in spots where they are situated; but in the latter case they cause a drying of the tissues along the edge of leaf at the outer extremity of the vein. When the psylla is situated in the secondary axils of the leaf, the petiole seems yellowish in colour and the attachment to the stem seems weak. About July 15 to 25 the psyllas were most abundant—the number of winged forms increasing until the 25th. A heavy rain on the 23rd cleared the trees of the honey-dew, and seemingly of quite a number of the psyllas. After another heavy rain on the night of July 27, I noticed

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that there were very few of the wingless forms, but a great number of the winged ones. Up to this time very few leaves had fallen off, although the growth of the trees was completely stopped; in fact, our trees have apparently made no growth at all this year, excepting a few that were free from the *Psylla*. At the time of writing, August 27, the wingless forms have again become numerous and the winged ones few.'—W. R. DEWAR.

Mr. John Chute, of Berwick, N.S., also observed that those of his trees which were infested by the Pear-tree Flea-louse made no growth.

This insect was first noticed as injurious in Canada in 1894, and a short account of it, with the best remedies for controlling it, appeared in my annual report for that year. The attack may be described as follows:—Small clear-winged insects, wedge-shaped like miniature cicadae, the head being broad, flat in front, and the body pointed behind; one-tenth of an inch in length, of a reddish brown colour, with broad black bands across the abdomen. These insects, at the slightest disturbance, leap from the foliage of infested pear trees and fly for a short distance. With the above described form, there will be found on the leaves the curious flattened oval larvæ, which, when first hatched, are extremely small, only one-eightieth of an inch in length, of a semi-translucent yellow colour, with bright red eyes. These grow rapidly, and in about a month pass through five nymph stages, during which the body retains its flattened form and becomes much darker until, in the full-grown nymph, the large wing-pads and the greater part of the upper surface are black. The eyes and sometimes the body between the black markings are crimson. The presence of this insect upon trees is easily detected by the copious secretion of honey-dew with which the leaves, limbs and trunks of the trees soon become covered, and upon which the dirty looking Sooty Fungus (*Fumago salicina*) develops. After a time the leaves and young fruit fall off and the trees assume an unhealthy, gnarled appearance. Hardly any new growth is made, and in cases of severe attack, trees die.

The life-history of this insect has been carefully worked out by Prof. Slingerland, of Cornell University, and has been fully described in Cornell Bulletin No. 108, published in 1896, as well as in U. S. Div. of Ent., Circular No. 7, 2nd series, by Mr. C. L. Marlatt.

The remedies for this insect are the spraying of the trunks of trees which are known to have been infested, during the winter or early spring, with kerosene emulsion, whale-oil soap solution, or whitewash. This is to destroy the hibernating adults, which pass the winter hidden away beneath flakes of bark or in crevices.

The eggs are laid very early in spring long before the leaf buds expand. After leaving their winter quarters and after the sexes have mated, the females lay their curious pear-shaped and tailed eggs (fig. 19) near the tips of the young wood. The young flea-lice hatch from these about the middle of May or sooner, and immediately begin sucking the sap from such leaves as have unfolded. Mr. Joseph Tweddle, of Fruitland, Ont., tells me that he obtained very satisfactory results in destroying the Pear-tree *Psylla* in orchards which he had sprayed with the lime and sulphur wash to control the San José Scale. He was under the impression that the mixture destroyed the egg upon the young wood, which is highly probable. It frequently happens that fruit growers do not know of the presence of this enemy in their orchards until they notice their pear trees becoming dirty and black during June, or a little later in the year notice that the leaves are falling. As

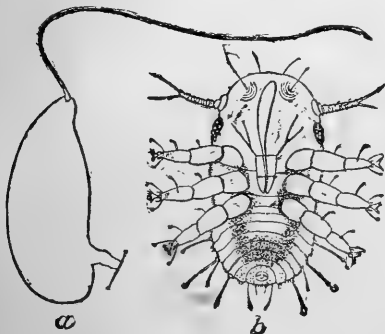


Fig. 19.—Pear-tree Flea-louse: a, egg; b, larva—both greatly enlarged.

(Marlatt, U.S. Dept. of Agriculture.)

soon as the insect is noticed in sufficient numbers to cause injury to the trees, these

latter should be sprayed at once with the ordinary one to nine kerosene emulsion or with a whale-oil soap solution of one pound to six gallons of water. This will destroy large numbers both of the nymphs and also of the mature insects. The most effective work, however, is done during the winter, when nearly all of the adults resort to the trunks and larger limbs for hibernation. In my report for 1900, at page 239, I drew attention to some good work which had been done by Mr. Henry Lutz, of Youngstown, New York State, by spraying with a lime wash. In 1896 a large Dutchess orchard belonging to him was almost ruined. In February, 1897, the whole orchard was thoroughly sprayed with whitewash, and two years afterwards this orchard was almost free from Psylla. Mr. Lutz explains his plan as follows:—‘During the cold weather in December we spread a canvas under the trees and then scrape off all the rough bark. This dislodges many of the torpid insects, which are burnt with the scrapings. We then give the trees a thorough coating of slushy whitewash made of freshly slaked lime that had been run off in a putty state, as masons usually make it for plastering. We thin this with skimmed milk and put it on the trunks of the trees with a brush, for those parts of the tree which we can reach. We thin down the whitewash with more milk and then give the whole tree a thorough spraying. In this way we destroy a large number of the hibernating Psyllas, and those which are not killed are so well sealed up that they cannot get out to lay their eggs. We spray again in March to coat the wood and buds, so that the few that are alive can find no favourable places to lay their eggs. The orchard where we experimented contained 1,000 trees, which were practically worthless, but since we began using the lime the trees have steadily regained their vigour.’

The PEAR-LEAF BLISTER-MITE (*Phytoptus pyri*, Nalepa).—This enemy has now spread to every part of the Dominion where pears are grown. Specimens were sent from Prince Edward Island by Mr. E. J. McMillan, the secretary of Agriculture for that province, and within the same week in June specimens came in for report from the provinces of Quebec and Ontario. Mr. E. P. Venables, writing from Vernon, B.C., says:—‘Pears suffered from the attacks of the Pear-leaf Blister-mite. This insect threatens to become a very serious enemy unless measures are taken to subdue it. I found that the lime, sulphur and salt spray was very useful in destroying it. It was applied just before the buds burst. One tree upon which the leaves were simply black with the work of the mite, was treated thoroughly and the following year was practically free from the insect. A few branches at the top of the tree, however, were as bad as ever. These had not been reached by the spray.’

Frequent experiments have shown that the best treatment for this pest is spraying the trees thoroughly with the lime, sulphur and salt wash just at the time the buds are bursting. The mites pass the winter hidden away securely beneath the bud-scales, which by the expanding of the buds in spring are opened up sufficiently to allow the entrance of liquid. Kerosene emulsion is useful to a certain extent, but sulphur has a specially fatal effect on all mites, and in practice the wash above mentioned has proved the best remedy against the Pear-leaf Blister-mite. See below for receipt of lime and sulphur wash at page 199.

#### THE SAN JOSE SCALE (*Aspidiotus perniciosus*, Comstock.)

This notorious insect has done much harm in Ontario orchards during the past season. The only part of Canada where the San José scale is now found as an orchard pest is in the Niagara peninsula and in the counties along the north shore of the western end of Lake Erie. The infestation has, however, decidedly increased a great deal during 1903, and has involved new orchards within the area known to be infested at the end of 1902. It is a matter of congratulation that the pest has not spread beyond those limits; for, although most of the leading fruit-growers seem to understand the danger

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of neglecting this terrible pest, yet there are many owners of small orchards who are doing nothing whatever to save their trees, and these centres are sources of public danger. An interesting occurrence of the small parasitic beetle *Pentilia misella*, Lec., was brought to my notice by Mr. W. O. Burgess, of Queenston, Ont. This useful little coccinellid was found in some abundance on apple and plum trees infested by the San José scale. It is a well known parasite of that scale insect, and although it has on several occasions been found in considerable numbers in infested orchards, I have never been able to see that it affected the abundance of the scales appreciably.

The Minister of Agriculture still maintains the fumigating stations at Vancouver, B.C., Winnipeg, Man., Windsor and Niagara Falls, Ont., St. Johns, Que., and St. John, N.B.; and a great deal of nursery stock has been passed through them during the past season. 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 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 and three ounces of water—exposure, 45 minutes.

During 1903 the experiments which had been carried on up to that time by the Ontario government to discover a practical remedy for the San José Scale were discontinued. After having demonstrated by the excellent work and most careful experiments of Mr. Geo. E. Fisher that this insect could be controlled by practical measures, the Provincial Minister of Agriculture considered it wise not to carry on these experiments any longer. Consequently, during the past summer, although helped with advice and publications by the Provincial Department of Agriculture and Prof. W. Lochhead, of the Guelph Agricultural College, fruit-growers have had to attend to this part of their work themselves. Some have applied the recommended measures and have been quite successful in their efforts when the work was done thoroughly, but the scale has increased to an alarming extent during 1903. The consensus of opinion is that when the well known lime, sulphur and salt wash, or the recent modification of it, in which the salt is omitted, is applied thoroughly as a late winter wash, it is a safe and reliable remedy for the San José Scale. It kills by contact with the scale and acts mechanically by coating the trees so that they are unsuitable for the young scales to establish themselves upon. This wash is used as a winter wash, and should be followed in summer with sprayings of the 1 to 6 kerosene emulsion. The preparation, as described in previous reports and as used to-day in many places, consists of about one pound of lime, half a pound of sulphur and six ounces of salt to every gallon of water in the wash when ready for use. Mr. G. E. Fisher, who tried an enormous number of experiments, found that the results of his investigation justified him in recommending that the salt might be omitted without loss of insect killing power. The original formula of the California wash is :

## LIME-SULPHUR-SALT WASH.

Lime, unslaked.....	40 lbs.
Sulphur.....	20 "
Salt.....	15 "
Water.....	60 gallons.

The chief difficulty in making this wash has been the expense and inconvenience of boiling it for two or three hours, so as to thoroughly dissolve the sulphur. This may

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be done either directly over the fire in iron kettles or in barrels by means of a jet of steam. Mr. G. E. Fisher describes his method of preparing this useful wash on a large scale, as follows:—

‘There are a great many ways of preparing lime and sulphur wash for spraying, and nearly every one who does it prefers his own way. When large orchards are to be treated, it is not practicable to cook the material to be used, by boiling it in kettles over the fire. In my practice I found that, with the aid of steam from an ordinary threshing engine, this most effective spraying material could be supplied in large quantity perfectly cooked and at a cost of from one cent to one and a half cents per gallon. A 12-horse power boiler will not furnish steam enough to cook 12 barrels at once, without extra heavy firing, and, with ordinary firing, such a boiler will not properly run more than 8 or 9 barrels, which will cook probably about 1,200 gallons of spraying material in 10 hours. The greatest drain upon the steam is in starting, when the water is all cold, and, to expedite matters and get some of the barrels under weigh, I found considerable advantage in starting about one third of them. We fill four barrels one-quarter full and then turn on the steam. With steam at from 80 to 100 lbs. pressure, these will be boiling in five minutes, when the steam is turned off these and on to four more barrels, and all the lime and sulphur are put into the first four as quickly as possible without making them boil over. It is best to turn off the steam while the lime is being slaked, as it lessens the danger of making the mixture boil over. When the lime is all slaked, the steam is turned on again and the mixture is left boiling until cooked. When the second four barrels are boiling, the steam is turned on to the third lot as with the first two, always returning the steam to the barrels as soon as the lime is all slaked. Managing in this way, we always had some material ready for use. That which is prepared late in the evening will still be warm enough in the morning, even in cold weather. In order to make up for the loss of liquid from boiling and to gradually fill the barrels to the proper depth, a small stream of cold water was kept dribbling into them at a rate which allowed the barrels to fill in the course of the two or three hours’ cooking necessary to reduce the sulphur. In this way the mixture was kept boiling all the time and the necessary amount of liquid was added. For boiling the mixture in the barrels, we have a quarter-inch pipe which reaches down to within four inches of the bottom of each barrel, and each pipe is provided with a stop-cock.’

‘When using a kettle, if I have only one, it is filled about one-third full and brought to a boil. The lime and sulphur are then added, and an old tin pail with a small hole in the bottom is hung over the kettle, and cold water dribbling from it into the kettle replaces the water which evaporates with boiling and increases the quantity. When kettles are used, if there are two, one may be used for heating water; for, while the mixture is cooking, cold water should not be added in sufficient quantity to check the boiling. I have generally slaked the lime in the barrels or kettles as it was required, but on some occasions we slaked it in another barrel by throwing boiling water over it and with just as good results. We certainly got our best results where each gallon of the wash contained one pound of lime and half a pound of sulphur, which we cooked from two to three hours. It is true Dr. Forbes got his wonderful results from a less quantity cooked one and a quarter hours. Mr. Pease, the California Scale Inspector, says it must be cooked at least three hours and that more cooking is better. He believes that this wash is of little use unless sufficiently cooked. We had good results and perhaps should be satisfied, but I think we have good reasons for using the larger quantity of material and cooking a long time. In Michigan again they used less material even than Dr. Forbes. A very common proportion in the United States is 40 lbs. of lime, 20 lbs. of sulphur, 15 lbs. of salt, in 50 imperial gallons of water.’

Dr. S. A. Forbes, who has been very successful in fighting the San José Scale, uses the Oregon wash and is quite satisfied with it. Writing at the end of the season of 1903, he says: ‘I am still using the ordinary Oregon wash of 15 lbs. of lime, 15 lbs. of sulphur and 1½ lbs. of blue vitriol, dissolving the lime and sulphur by boiling for

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about an hour and then adding the blue vitriol, which has been dissolved in hot water, and boiling for 15 or 20 minutes longer?

Mr. W. H. Owen, who has done a great deal of work against the San José Scale, on Catawba Island, Ohio, and has tried all of the different remedies which have been suggested from time to time, wrote me recently: 'In 1903 the original California formula was somewhat modified. The quantities of the new formula being lime 15 lbs., sulphur 15 lbs. and salt 15 lbs. to the 50 gallons of water, and this gave equally good results with the old formula. The Oregon wash of 15 lbs. of lime, 15 lbs. of sulphur and 1½ lbs. of blue vitriol, is what I used during the past season, and I cannot expect to find anything that will do better work than this, both on the San José Scale and the Leaf Curl. When properly made it surely is a perfect insecticide and fungicide. Too much stress cannot be laid upon proper making; for I believe that failure in obtaining satisfactory results can in most cases be traced to careless making.'

The lime-sulphur-and-salt wash, as made in the old method by boiling for a long time, is very fatal to scales, and many other kinds of insects, and there has been a constant effort made to see if the long boiling cannot be avoided. The point aimed at is to dissolve the sulphur thoroughly by means of the lime and heat, and to form a double sulphide of lime. There is an excess of lime in all the formulas used, but this is in no way detrimental. The mixture, however, is not a pleasant one to use, being caustic if it gets on the bare flesh, and is very destructive to clothes of workmen using it. For this reason old clothes should be worn and the hands should be protected with gloves. It must only be used as a winter wash, for if of sufficient strength to destroy the scale, it would injure foliage as well as sensitive stock in autumn before the buds are dormant; but, when buds are quite dormant, it may be used upon all fruit trees and other hard-wooded plants liable to infestation by the San José Scale. Its effectiveness has been proved by several, and one instance which has been seen by many of our Ontario fruit growers, is the case of some plum and peach trees in the orchard of Mr. W. W. Hilborn, at Leamington, Ont. In the spring of 1903, Mr. Hilborn found that a small block of trees was badly infested with the scale. He at once procured a plant for making the lime and sulphur wash and sprayed the trees thoroughly. These trees were examined by me with great care on November 25 last, and I could not find a single living scale. All experimenters recommend that this wash should be applied while it is hot; but, as a matter of fact, this is seldom done in practice, although those who have used hot or warm wash will notice how much more convenient it is to spray when in this condition, and it certainly is more effective in killing the scale.

A simple formula for making this wash in small quantities is 1 lb. lime, ½ lb. sulphur, and 3 gallons of water.

## THE NEW LIME-SULPHUR-SODA WASH.

The chief difficulty in making the wash has been the expense and inconvenience of boiling it for such a long time, to thoroughly dissolve the sulphur, and several of our fruit growers have inquired for information concerning some experiments which have been mentioned in the agricultural press and which were undertaken to dissolve the sulphur with caustic alkali and lime, instead of the troublesome and lengthy boiling. These experiments originated with Professors Victor Lowe and P. H. Parrott at the New York Agricultural Experiment Station, Geneva, N.Y., as set forth in the Station Bulletin No. 228, 1902, and consisted of dissolving the sulphur by means of caustic soda or caustic potash in addition to the lime. In making the wash, 40 lbs. lime were slaked in hot water, using only enough water to make it boil rapidly, and while slaking 20 lbs. of ground sulphur, which has been made into a thin paste, is added and thoroughly mixed with the slaking lime. Five pounds of caustic soda in solution is then poured in with more water as needed, and the whole is stirred thoroughly. As soon as chemical action has ceased, hot water is added to make the wash



up to 60 gallons, and the mixture is then ready for immediate use. In making the above wash, it was found that to secure the proper chemical action the quantity could not be reduced lower than: lime 4 lbs., sulphur 2 lbs., and caustic soda (the ordinary concentrated lye of commerce)  $\frac{1}{2}$  lb., water 6 gallons. The rule is to use one-quarter of a pound of caustic soda, or potash, to each pound of sulphur. With the exception of heating the water, the whole of the cooking of this wash can be done in a half barrel, and takes from ten to twenty minutes. From the ease with which this wash can be made and from the fact that Mr. Parrott tells me that, although 'the results upon the scale differed with different lots of the mixture, some of the applications were entirely satisfactory,' I believe it is well that several people should try this method of manufacture. The trouble of making the lime-sulphur-and-salt wash has certainly prevented the use of such a valuable mixture to a large extent. I regret to say that my own work with it did not begin soon enough for me to report upon it now. I can merely say that the lime and caustic potash do dissolve the sulphur and that the appearance of the wash is what it ought to be.

Mr. F. T. Shutt, the chemist of the Dominion Experimental Farms, has kindly carried out some test preparations by this convenient new method of making the wash and has handed me the following resumé of his work:—

#### ON A NEWLY-PROPOSED METHOD OF PREPARING THE LIME-SULPHUR WASH.

(By FRANK T. SHUTT, M.A., F.I.C., F.R.S.C.)

In the report of the Division of Chemistry of the Experimental Farms for 1902, the results of a series of experiments in the preparation of the lime, sulphur and salt wash by boiling, are given. Since the appearance of that report a method has been proposed by the New York (Geneva) Experiment Station, which obviates the necessity of boiling—the chief drawback to the more common use of this valuable remedy. The modification consists in the addition, at a certain stage in the preparation, of strong lye, such as Babbitt's or Gillett's. The proportions and preparation as given in Bulletin No. 228 of the above named Experiment Station are as follows:—

Lime (unslaked).....	40 lbs.
Sulphur (ground).....	20 "
Lye, concentrated.....	.5 to 10 "
Water.....	60 gallons.

'In the preparation of the mixture the lime was slaked, preferably with hot water, and while it was slaking vigorously, the sulphur, which had been made into a thin paste, was added and thoroughly mixed with the slaking lime. The caustic soda was then added, with water as needed, and the whole stirred thoroughly. As soon as the chemical action has ceased, the required amount of water, preferably hot water, is added, and the mixture is ready for use.'

It will be noticed that in this process there is no boiling and no salt, an ingredient in the old formula which apparently had no direct value, but was useful in raising the boiling point of the mixture, thus ensuring a more complete union of the sulphur and lime.

At the request of the Entomologist (Dr. Fletcher), we made several trial preparations in the laboratory and found that the proposed method is quite workable and simple, and yields a product in which there is *very little uncombined sulphur*. This latter is an essential point, as undoubtedly it is the sulphur compounds that give this wash its great value for destroying the scale. It is necessary to this end that the sulphur be added (in a thin paste) while the lime is still actively slaking—for which purpose care should be taken to use only a sufficiency of water—and the mass stirred

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vigorously. As soon as the sulphur paste is poured on to the slaking lime, add the solution of lye, with such further quantities of water as may be necessary, stirring and mixing, until all bubbling ceases. There is now an orange-yellow, pasty, homogeneous mass, which can be diluted to the requisite volume, either at once or at any subsequent time, if kept out of contact with the air.

As far as one can judge from what might be called the chemical or physical point of view, this wash should prove equally effective with that prepared by boiling.

F. T. S.

In an excellent bulletin just issued by Prof. J. B. Smith, of New Jersey, entitled 'Insecticides and their use,' this lime, sulphur and soda wash is mentioned and some valuable suggestions are made. Prof. Smith says: 'This wash has been found quite effective, but it is not so good as the boiled mixture, and costs a little more.' He also draws attention to the fact that warm water must be used as well as a good quality of stone lime and of caustic soda, and further that it must be remembered that a can of lye does not equal a pound.\* He further states that 'all these combinations of lime and sulphur are more or less unstable and sooner or later the lime settles and the sulphur forms long spicules. When this occurs, the mixture is ineffective in proportion as the sulphur has become separated out. The best boiled combinations become useless in forty-eight hours, and in all cases the wash is most effective just after it is made.'

The above extracts from Prof. Smith's bulletin indicate the importance of using the lime and sulphur washes while fresh; but the statement that 'the best boiled combinations become useless in forty-eight hours,' is probably too sweeping.

A point upon which too much stress cannot be laid is the great importance of washing out thoroughly all pumps and hoses used for spraying caustic or corrosive insecticide and fungicide washes.

## FOREST AND SHADE TREES

Forest insects and those which attack shade trees in cities, have been, on the whole, less injurious than usual during the past season. There were, however, one or two outbreaks which require mention. The White-marked Tussock-moth has increased very much in the cities of Toronto, Montreal and Kingston, so much so that remedial measures are now urgently needed, or the beautiful shade trees in those cities will suffer irreparably at no distant date. Something has been done in the past by the city authorities to control this insect, but of late years they seem to have relaxed their efforts, and the insect is increasing in numbers. A remarkable outbreak of the Maple Soft Scale (*Pulvinaria innumerabilis*, Rathvon) occurred on shade trees in the cities of London, Woodstock and Hamilton, as well as in other places in south-western Ontario.

The well known Fall Webworm (*Hyphantria textor*, Harr.), which for some years has been occurring only in small numbers, during the last season increased sufficiently in most parts of the Dominion to attract general attention. The unsightly webs were very conspicuous in British Columbia and in many places in Ontario and Quebec. The webs of the caterpillars are so easily seen that this insect, if attended to, can be controlled with comparative ease, by spraying the trees with poisonous applications or by cutting off the webs, each of which contains a whole colony of

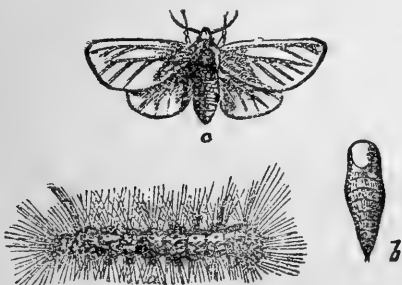


Fig. 20.—The Fall Webworm: a, caterpillar; b, pupa; c, moth.

\*The contents of several cans of concentrated lye which were examined here in no case quite came up to 1 lb. avoirdupois.

caterpillars. This must, however, be done before the caterpillars reach full growth, or the work is useless. I have known of one instance where a municipal body with all good intentions employed a man to cut out all of the webs of this insect and those of the Tent Caterpillar in winter time, under the supposition that by this means they were controlling those enemies. It is true the trees were more slightly when these nests had been removed; but the operation in no way affected the abundance of the species the following summer, because the caterpillars only live in the nests until nearing full growth, when they leave them and pupate or build their cocoons in other places. The Tent Caterpillars pass the winter inside the eggs, which may be found on trees, and the Fall Webworms as pupæ buried in the ground. Prof. Lochhead reports 'that the Fall Webworm was very abundant in western Ontario late in summer, not only on shade trees, but on many kinds of fruit trees, and unquestionably did considerable harm. On account of the scarcity of labour in rural sections, few attempts were made to get rid of the ugly webs filled with caterpillars. Unless parasites thin them out very much, there is every likelihood that the Fall Webworms will be very numerous next season.' The Negundo Plant-louse (*Chaitophorus negundinis*, Thomas) was observed as injuriously abundant in Winnipeg, Regina and Calgary, the shade trees, which are largely Ash-leaved Maples, being much disfigured by the copious deposit of honey-dew on the leaves, and the Sooty Fungus which grows upon it. These trees attracted swarms of flies during the daytime and of moths at night. The remedy recommended for clearing these trees was to spray them with kerosene emulsion, 1 to 9, or whale-oil soap, 1 pound in 6 gallons of water, with or without tobacco. The tobacco, however, adds considerably to the killing value of the wash. The Spruce Gall-louse (*Chermes abietis*, L.) has spread widely through the Dominion, and has been the cause of a good deal of injury to spruce trees. In the forest, nothing can be done to check the spread of the insect; but in the case of ornamental trees, good results have followed spraying with a tobacco and soap wash. The Fall Cankerworm was very abundant and destructive in the woods around Ottawa early last spring. The caterpillars were not quite full grown on June 12 last, when the first heavy rains came, which broke the exceptional drought which up to that time had prevailed throughout eastern Ontario. Previous to that they had been literally swarming in many woods along the Ottawa river. After the rains they suddenly disappeared, and the total absence of both male and female moths in the woods in autumn was noticed by many. It is possible, therefore, that there will not be a recurrence of this attack for some time. The Birch Skeletonizer (*Bucculatrix canadensisella*, Cham.) did some harm to birch trees of all kinds again last year in eastern Ontario. The attack, however, was not nearly so severe as in the two previous years, nor was its work supplemented by that of the large aphid, *Callipterus mucidus*, Fitch, and the small green leaf-hopper, *Empoasca smaragdula*, Fall., which for the last two years have perhaps done as much harm to trees on the Central Experimental Farm as was done by the *Bucculatrix* caterpillars. On my return to Ottawa on August 21 last I found the birch trees on the ornamental grounds of the Central Experimental Farm attacked in some places by the Birch Skeletonizer to such an extent that some trees looked about half clothed with foliage. These were at once sprayed with a whale-oil soap and tobacco wash, which was quite effective, and no further injury was done. Should this insect again occur, trees should be examined in July and early August, and, if the small caterpillars or the round white pseudo-cocoons in which the caterpillars pass their moults are seen in numbers, the trees should at once be sprayed before the foliage is injured to a conspicuous extent.

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THE WHITE-MARKED TUSSOCK-MOTH  
 [*Hemerocampa (Orgyia) leucostigma*, S. and A.]

*Attack*.—Slender, sparsely hairy caterpillars, from one and a quarter to one

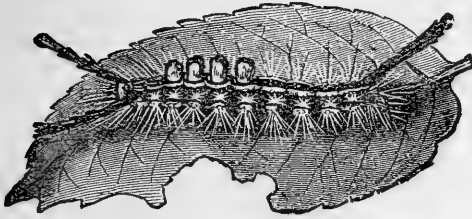


Fig. 21.—The White-marked Tussock-moth : caterpillar.

and a half inches in length, blackish above and paler beneath, with two bright yellow stripes along the back, most conspicuous towards the end of the body. There are four short brush-like tufts of whitish hairs on segments 5, 6, 7 and 8. The head chestnut red ; a large patch on segment 2, and two small glandular spots on segments 10 and 11, bright vermilion red. From each side of segment 2, close behind the

head, are long plume-like tufts of black, barbed and knobbed hairs ; a similar plume ornaments segment 12. When full grown these caterpillars have a decidedly handsome appearance, which is well represented in the accompanying figure. The male



Fig. 22.—The White-marked Tussock-moth : male moth.

moth measures about an inch and a quarter across the wings, and is marked as shown in Fig. 22. The colour is gray and the wings are crossed by wavy bands. The base of the fore-wings bears a dark patch, and there is another of smaller size towards the tip. The popular name is given to this moth from the presence of a small white spot near the outer hind angle of the fore-wings. The female is a large-bodied wingless pale gray creature, with only rudiments of wings. On emerging from the cocoon she crawls on to it and seldom moves from it. After pairing, she lays a mass

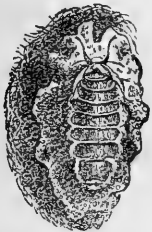


Fig. 23.—The White-marked Tussock-moth: female moth.

of eggs, from four to five hundred in number, generally on the outside of her cocoon, and then dies there. These eggs are covered over as laid with a white frothy fluid, which dries over the eggs and protects them through the winter. There is in Canada only one annual brood of this insect. The eggs may be found during the winter on the trunks of trees upon which the caterpillars had fed the previous season. The young caterpillars emerge from the eggs at the end of May or early in June, and soon crawl up and distribute themselves throughout the foliage of the trees, feeding at first beneath the leaves, and when disturbed letting themselves down by a slender silken thread. By the middle of July the caterpillars have for the most part become full grown and are preparing to spin their cocoons. As they increase in size, they become very

ravenous and strip entire trees, eating the cellular tissues between the veins of the horse chestnut leaves, which appears to be the favourite food plant, and producing a characteristic injury, which is easily recognized. These caterpillars have a habit of wandering from branch to branch and from tree to tree, which has given rise to the practice of banding trees with strips of cotton batting. This gives a very untidy appearance to streets and does not do very much good, certainly not enough to atone for the unsightly appearance of the trees. The most effective remedies for the White-marked Tussock-moth are (1) the collection of the conspicuous egg masses from the trunks in winter or before they hatch in spring. This may be easily done by means of a small wire brush on the end of a long pole which will reach up among the larger branches of the trees. Such a brush as this was devised by the late Alderman Hallam, of Toronto, and used to good effect on the city shade trees during a previous outbreak of this insect. (2) Undoubtedly the best remedy is the systematic spraying

of shade trees with some arsenical poison as soon as the young caterpillars hatch from the egg, or as soon afterwards as possible. This work, if properly done, will destroy every caterpillar and render unnecessary the collection of the eggs in winter and the use of unsightly tree protectors, bandages of cotton batting, or sticky substances, all of which are more costly and objectionable. It might be well to point out that, when municipal bodies adopt the plan of collecting the cocoons in winter, it would be well to place these for a time in some place where any parasites which might be passing the winter in the cocoons could emerge and escape, but where the young caterpillars upon emerging would find it impossible to gain access to any trees. This might be done by putting them in an upper room of some building from which the parasites could fly out of the windows, but from which the young caterpillars could not crawl to trees which would serve them as food. Deprived of food, they will soon starve after leaving the egg.

## 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.

The season of 1903 has been a poor one in the Ottawa valley, but in the greater part of western Ontario the crop has been excellent both as to quality and quantity; parts of the province of Quebec also report good crops, principally where Bokhara clover grows extensively; also in districts which had sufficient moisture in the spring.

The season opened very early; the colonies were set out on their summer stands on March 21. The temperature on that date being 48; and the day bright and mild was most favourable for the cleansing flight of the bees. Then followed several days of cool windy dull weather, which kept the bees confined to their hives; this continued all the rest of March. April was also very unfavourable, being cool and windy. During the greater part of the latter month there was only about three-quarters of an inch of rain, all growth and bloom being thus kept back. May set in warmer; the bees gathered pollen freely, and built up fairly well. It was necessary to feed the bees during May to keep up brood rearing. Only about a quarter of an inch of rain fell during May, and up to June 8 the land was so dry and hard that no clover of any account came in bloom. After June 8, abundance of rain fell, many flowers appeared, and the small amount of surplus honey was gathered after that date. Swarming was light owing to the poor season. There being no fall honey flow from any source all supers were removed on August 26.

On September 1 all colonies were weighed; any that did not weigh 50 pounds and over were fed. When feeding, care must be taken not to feed weak swarms, but the strong ones; then, when these have filled the frames these latter should be given to the weak colonies; otherwise the weak colonies are liable to get robbed. A much better plan of bringing colonies up to the required weight is, in the extracting season, to save some of the well-sealed combs to fill up the light colonies with them. There is then very little danger of their being robbed.

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On November 24 all colonies were weighed and found to be in good condition. They were then put into their winter quarters.

Returns from the Experimental Farm apiary averaged 23 lbs. per colony.

Meetings were attended during 1903. The Ontario Bee Keepers' Association at Barrie and Trenton; also farmers' and beekeepers' joint meetings at the following places: Manotick, North Gower, Stittsville, Richmond, Malakoff, Lanark, Wellman's Corners, Bell's Corners, Jockville, Carp, Kinburn, Smith's Falls, Leonard, Metcalf, Balderson and Innisville, in Ontario; Grenville, Lachute, St. Andrews, Compo, Buckingham and Templeton in Quebec.

## INSULATING HIVES FOR OUTSIDE WINTERING.

Two colonies of equal strength with good laying queens in Langstroth hives were taken for this experiment. The hives were insulated against the winter cold by air cushions in the following manner:—

Slats 1 inch thick are nailed at intervals all round the hive, on these is packed one layer of thick brown building paper and then a layer of oiled paper, which increases the durability and keeps out vermin. In order to provide extra protection to the hive, a box six inches wider and six inches longer was placed over it with an opening cut at the entrance 1 inch by 2 inches, all other openings being closed.

The wooden cover of each hive was 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 placed on the top of the cushion and a second cushion added, with the top of the outside box over it. The bees were put into winter quarters on November 18, 1902. No sound could be heard from those colonies all winter, up to March 10, when a slight hum was perceptible. On March 20, 1903, the first bees made their appearance; there were many dead bees at the entrance of the hives. On March 21, the outside cases were removed, leaving the paper and one chaff cushion on during the cold spring. Upon examination one colony was found to be in fairly good condition, the other very poor, with many dead bees on the bottom board. A few days afterward the latter was found to be deserted. The frames in both cases were all dry and clean and had abundance of honey to carry them through from November to the clover bloom. Weight, when put into winter quarters, 53½ lbs. each; in spring, 37¼ pounds each. Owing to the cool, backward spring, the surviving colony did not build up until May 1, when warmer weather set in; the bees at once began gathering pollen and built up very rapidly. The colony was in excellent condition for a honey flow, but during May and the early part of June the weather was very dry and warm, keeping all bloom backward; the bees, therefore, made but little surplus honey.

This experiment is to be tried again this winter.

## EXPERIMENTS TO TEST WHETHER DAMPNES OR MOISTURE WOULD BE INJURIOUS TO BEES IN THEIR WINTER QUARTERS.

Three colonies were selected for this experiment, all of about equal strength, and all in Langstroth hives, weighing on an average 55½ pounds each. 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. Four pails of water were then put on a table in such a way that the three hives were set resting on the edge of the pails, allowing the full surface of water to be exposed. The cellar was kept at a very even temperature of 42 to 43 degrees, and was well ventilated during the whole winter. The bees could be seen hanging below this frame in a quiet cluster, and there were very few dead bees on the bottom board, and no signs of dysentery.

On March 22, the day being fine, the colonies were removed to the bee yard, where all began flying at once. Average weight of the three colonies when set on their summer stands, 43½ pounds each. From March 22 to May 1, the weather, although bright, was cool and windy, and very little flying took place. After May 1, the weather became considerably warmer, and the bees began building up rapidly. They were in excellent condition by May 24.

#### EXPERIMENT IN FEEDING BEES IN THEIR WINTER QUARTERS.

Many letters have been received from people who have only a few colonies of bees, stating that when carrying their bees into winter quarters they had discovered there did not seem to be a sufficient store of honey in the hive to carry the bees through the winter. To gain information as to the best method of overcoming this difficulty the following experiment was tried with six strong colonies of bees:—

Four frames of sealed honey were taken from each of the six hives, leaving the cluster on the four remaining frames. The four frames were left in the centre of the hive with a division board at each side, and some light packing placed between the division boards and the sides of the hives. The wooden covers were removed and replaced by large propolis quilts made of heavy canvas. Over the top of the propolis quilt extra packing was added to keep in the heat, absorb moisture and prevent draughts or upward ventilation. The bottom boards were left on as they came from the bee yard, leaving the entrance wide open. The experiment was made as follows:—

1. Two colonies received maple sugar of the best quality.
2. Two colonies received partly filled sections of honey.
3. Two colonies received candied honey and sugar.

Each colony when put on this test, weighed 31 pounds, and each was given 5 pounds of its respective food to start with. The experiment lasted from November 18, 1902, to March 22, 1903. The two colonies fed on maple sugar consumed 11½ pounds each, they were examined every two weeks and water added to the sugar through holes in the tops of the cakes, keeping it soft and moist.

The two colonies fed on partly filled sections of honey, consumed during the same time 14¾ pounds each. There was for several reasons considerable waste in this test; consequently if partly filled sections could be sold even at a reduced price it would be advisable to sell them instead of feeding back.

The two colonies that were given candied honey and sugar consumed 10¾ pounds each. The candied honey was moistened from time to time, which made it easier for the bees to suck it up. Candied honey is made as follows: Take good thick clover honey, and heat (not boil) it until it becomes very thin; then stir in it fine granulated sugar. When the honey has dissolved the sugar, pour it into another vessel, and, when it has cooled sufficiently, thoroughly knead it with the hands. The kneading makes it more pliable and soft, so that it can take up more sugar. The kneading operation, with the adding of fine sugar, should be continued until the dough is so stiff as to be quite hard to work. It should then be allowed to stand for a day or two, and, if at the end of that time it is so soft as to run or to be sticky, a little more sugar should be kneaded in, so that it may be cut into cakes of a convenient size. These cakes are to be placed on top of the frames in such a way that the bees can get at them easily.

The colonies in all the three tests came through in excellent condition. Any one of the three methods may be safely followed, but I would strongly recommend examining and weighing all colonies the first week in September. At that time every colony should have a good laying queen, and should weigh over 50 pounds. In seasons when there is no autumn flow of honey, all colonies in Langstroth hives weighing less than 50 pounds in September should be fed up to that weight at least. The best method for getting colonies up to the required weight is, when the extracting takes place, to save several full well-sealed combs, then remove some of the light ones out of the hives and replace them with the heavier full frames. If no honey is available, feed sugar



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syrup. This plan is rather a tedious one and great care must be taken not to daub the hives or appliances, as robbing at this season of the year is very easily started and very hard to stop.

If the colonies that are short of stores are weak or feeble in number of bees, they should then be fed with syrup. In order to provide for them, feed the strongest colonies you have, for instance, by putting in their hives extra frames and feeding the syrup in a Miller feeder. A good strong colony will take down 10 to 15 pounds in a warm night. Continue the feeding until you have sufficient frames well sealed to make up the required weight. The full frames are then removed and given to the weak colonies that are short of stores; by this method there will be very much less danger of robbing, as the strong colonies are well able to look after themselves.

Sugar syrup may be made as follows: Use the best grade of granulated sugar, two parts to one of water by weight. The water should first be brought to a boil, then the pan or vessel set back on the stove so that the boiling will not continue but the water be kept sufficiently hot to dissolve all the sugar. The sugar should be poured in slowly and thoroughly stirred until all is dissolved. The syrup should then be fed in a lukewarm condition..

## FOUL BROOD.

Much attention has been drawn of late to this most destructive disease of bees, which affects particularly the larvæ or brood, causing them to die, mostly at the age of six to nine days. The disease is spread by bees feeding their larvæ with infected food, and is carried to new colonies by bees robbing diseased colonies. It is thought advisable to publish in this report the McEvoy method of detecting the disease and stamping it out when found in an apiary. With reference to this method of treatment of foul brood we have much pleasure in quoting the following from Wisconsin Bee-keeping, Bulletin No. 2, 1902, by N. E. France, State Inspector of Apiaries.

'In Wisconsin I have tried many methods of treatment and cured some cases with each method, but the one that never fails, if carefully followed, and that commends itself, is the McEvoy treatment. It has cured foul brood by the wholesale, thousands of cases.' Mr. McEvoy describes his method as follows :—

## THE MCEVOY TREATMENT.

*How to detect foul brood.*—When any dead brood is noticed in a hive, a sure way to ascertain whether the cause of death is the disease known as foul brood, is to put the head of a pin into a cell of a comb and draw it out; if the matter contained in the cell adheres to the pin's head and can be stretched about three-fourths of an inch, it is undoubtedly a case of foul brood. But every bee-keeper should be able to recognize the disease at a glance without having to use a pin, as above said; he should learn to know the stain mark of foul brood when he sees it. The manner of proceeding to examine an apiary in which foul brood is suspected, is as follows:

Before opening any of the hives give every hive in the vicinity a little smoke at the entrance. This will check the bees for a time from coming from other colonies to disturb you when you have a hive open to examine the combs. After taking a comb out to examine it, turn your back to the sun, and, holding the comb in a slanting position, let the light fall on the lower side and bottom of the cells; look there for the dark scales left in the cells and formed from the dried up, decayed bodies of the dead larvæ. Another sign of the presence of foul brood is that several of the cappings have a small hole in them, but this also appears in the case of cells containing brood killed by other causes than this disease.

[Mr. Charles O. Jones, of Missisquoi, Que., describes the symptoms of foul brood as follows in the Montreal 'Weekly Star' :—

'Of the diseases affecting the brood, the most serious is foul brood, which has appeared in some localities in Ontario in a virulent form, but is being successfully

combated. The symptoms of this disease are not easily mistaken by one who is at all familiar with it. The brood hatches unevenly and the cappings have a shrunken appearance, and many of them are perforated as if the bees had begun uncapping the brood. The dead brood will be found adhering to the side (lower side) of the cell, and of a brownish colour. On inserting a small stick, the decomposed brood will adhere, and when withdrawn three-fourths of an inch, will still cling to the stick. Beside this "ropiness," the dead brood has a distinct odour very much like old glue. If the disease has developed sufficiently, this odour may be detected on removing the covering from the bees. These two last symptoms are peculiar to foul brood, and if present, are considered a certain indication of infection.']

#### HOW TO CURE INFECTED APIARIES.

Every infected apiary should be treated according to the condition in which it is found, and at the same time not only to stamp out the disease, but also so as to induce considerable increase in the colonies, and end by having every colony in first-class condition. I may therefore first explain how I proceed. The best time for this work is while the bees are gathering freely during the honey season.

For this, taking two hives at a time, I shake off the bees from them with one of the queens, and give them a clean hive with foundation starters, leaving in the two original hives one queen and only about a quart of bees to take care of the brood still unhatched in those two hives. I now remove the bottom of one hive and the top of the other, and place the first on the top of the second, so that the bees may unite and, as the young bees hatch out, form one strong colony. By the time that most of the brood is hatched I have from the two colonies, when united, one large swarm of young vigorous bees. This swarm must then be shaken into a fresh clean hive with foundation starters.

I have now two first-class colonies, each containing a queen, one from the bees first shaken out of the two original infected hives, and another from the brood left in the original hives with a queen and a small number of bees to take care of it. Both of these colonies must now be treated to destroy the disease. All handling of diseased colonies, especially during warm days should be done in the evening, when no bees are flying. This will prevent robbing, and also will prevent bees from diseased colonies mixing with those from sound colonies, going into their hives with them. Again, by doing the work in the evening, it gives bees which have been treated a chance to settle and quiet down before the morning.

[Mr. Jones, of Missisquoi, explains the same treatment as follows:—

'The cure, although simple, requires great care to carry it out successfully. A clean hive containing frames with starters of foundation, should be placed on the old stand after removing the affected hive. Remove the combs from the affected colony, and shake the bees in front of the clean hive into which they will run. This should be done at nightfall, when the bees are all at home, and then there will be no danger of robbers getting at any of the tainted honey. Leave the bees in the new hive for at least four or five days, by which time they will have used all the honey they carried with them in comb-building, when you can remove the starters to melt into wax, replacing them with frames filled with sheets of foundation, and your cure is effected. I would advise burning the combs and honey removed from the hive and thoroughly disinfecting the hive by scalding before using again.

'Some authorities advocate caging the queen for ten days or so, to prevent brood rearing until all danger of infection has passed, but I consider this only as an extreme precautionary measure; in fact, hardly necessary.']

*Treatment during the Honey Season.*—When the bees are gathering freely, remove the combs from the hive in the evening, replacing them by frames with comb foundation starters, as said before; then shake the bees from the combs into a clean hive and let them build comb for four days. By that time they will have made the starters into combs, and will have stored in these the infected honey which they brought from the

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old combs. On the fourth day, in the evening, replace those combs containing the infected honey with full sheets of fresh comb foundation, and the cure will thus be complete. By this method of treatment, all the infected honey is removed before the full sheets of foundation are used.

When only a few cells are found with foul brood, after shaking off the bees for treatment, two hives may be filled with the combs containing the brood; then place these two hives on top of each other, as explained before, keeping them shaded from the sun until most of the brood is hatched. Then, in the evening, shake the bees from both hives into another single hive and give them frames with comb foundation starters. Let them build comb for four days, as above said, after which, in the evening, take out the new comb and give the bees comb foundation to work out to complete the cure. If the diseased colonies are weak in bees, the bees of two, three or four should be put together, so as to have a strong colony to start the cure with, as it does not pay to spend time over weak colonies.

*When bees are not gathering honey.*—An infected apiary can be cured of foul brood by removing the infected combs in the evenings and giving the bees frames with comb foundation starters on. Then, also in the evenings, feed the bees plenty of sugar syrup; they will draw out the foundation and store the infected honey which they took with them from the old combs. On the fourth evening, replace the new combs made out of the starters by frames with full sheets of comb foundation, and feed plenty of sugar syrup every evening until all the colonies are in first-class order. The sugar syrup should be made of granulated sugar, using one pound of water to every two pounds of sugar, and bringing it to a boil.

*Treatment after all honey gathering is over.*—When the disease is discovered in a few good colonies after the honey season is finished, the best plan is to leave them until an evening in October. Then take every comb out of the diseased colonies, replacing them by six combs of all-sealed or capped stores from sound colonies. Place a division board on either side of these all-capped combs. These colonies will thus be in perfect condition for wintering, and the disease will at the same time be stamped out; for, as there are no empty cells, the bees must have kept the infected honey which they took out of the old combs, until it was consumed, as they could not find a place in the all-capped combs to put it.

If there is a scarcity of all-capped combs from the sound colonies, as many as are required can be secured by putting Miller feeders on sound colonies in the evenings in September and feeding the bees all the sugar syrup they can be made to take; then, in October, each of these fed colonies can spare the two outside combs, which will be perfectly capped all over down to the bottom of the frames. These all-capped combs will provide plenty of good stores to carry out this autumn method of treatment.

All the old infested brood combs which have been removed from the hives, must be burned or made into wax, as well as all the combs made on the starters by the bees during the four days of the treatment.

As to the infected honey, I have always been opposed to having it treated and then fed to bees, for fear that the treatment may not be thorough enough. My recommendation is to bury it in the ground, as well as all the refuse from the honey extracted. This applies also, of course, to the honey stored up in the combs during the four days of the treatment.—W. McEvoy.

*Treatment of the Hives and Frames.*—In Mr. McEvoy's treatment of foul brood, there appears to be a danger that the hives themselves in some of their parts might be tainted with germs of the disease. We would, therefore, strongly recommend to disinfect the hives and the frames that have contained foul brood, by a thorough scalding. This operation is very simple; and, in view of the great losses that have been occasioned by foul brood, it is important to neglect no means to secure success in stamping out the infection.

JOHN FIXTER.

# DIVISION OF BOTANY

## FODDER CROPS.

The season of 1903 was not a good one for the production of heavy crops of fodder of any kind. In the East an exceptionally prolonged drought prevented grass and clover from starting well, and although, when rains came, these crops picked up in a surprising manner, still the yields were below the average in most places. A cool, damp autumn prevented corn from maturing and made it difficult to cure all hay crops.

Among various fodder plants which have been grown on the experimental plots at the Central Experimental Farm, one which has lately received much attention is Sainfoin (*Onobrychis sativa*, DC.). This beautiful plant, which may be known at once by its pinnate leaves and large cones of rose pink flowers on slender stems, is allied to the clovers, and, as a rule, is spoken of as a clover in the same way as Alfalfa or Lucerne is. It was noticed on the experimental plots that the flowers of this plant were extremely attractive to bees, and it is also a producer of good fodder, suitable for all stock. It is not as heavy a cropper as Alfalfa, but like that is a persistent perennial which roots deeply and in localities which suit it, produces heavy crops of hay.

The following notes on the cultivation of this plant have been prepared mainly by Mr. John Fixter, the farm foreman at the Central Experimental Farm.

### SAINFOIN.

This clover has attracted much attention on the Central Experimental Farm, both as a fodder plant and also as a honey producer. In its cultivation and manner of growth it resembles alfalfa, but it is slightly finer and grows thicker in the bottom, having a more decided stooling habit, which makes it better for pasture. It is specially liked by sheep. The soil best suited to the growth of this plant seems to be a deep rather dry loam, containing a fair proportion of lime with good natural drainage. It will do well upon almost any soil that is well drained, provided it gets a good start. Heavy clay and light sandy soils both produce excellent crops of sainfoin, but on the latter it naturally requires generous manuring. It should never be sown on land likely to be covered with water at any season of the year. The amount of seed sown under ordinary conditions is about 20 lbs. per acre. Great care should be taken to secure new and plump seed; the hulled seed is preferable when it can be obtained, as it is easier to sow and germinates more quickly. A good seed bed is of great importance, and one of the best methods for preparing this, and also at the same time clearing the land of weeds such as quack grass and thistles, is to cultivate it with a firm-footed cultivator. If the field has been in meadow or grain, do not plough, but simply cultivate and harrow; first cultivate as shallow as possible, then pass the heavy iron harrows at a good sharp walk across the first cultivating. This operation will break up the sod or stubble very fine and leave it on the surface to dry out. The second cultivating should be in the opposite direction to the first, and likewise the harrowing. By this operation two-thirds of the sod will be loosened from its roots. It usually requires about four cultivations and four harrowings to make a perfect job. All this work must be done on fine sunny days, and the sooner after harvest the better. The cul-

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tivating and harrowing must be gauged by the growth. If possible, every leaf must be cut off and kept out of sight, and all vegetation brought to the surface to be dried by the sun. This dead but valuable material may, during the autumn, be ploughed under to decay and add to the fertility of the soil. By the next spring this land should be in perfect condition for sowing. The best time to sow is as soon as the ground can be got ready in spring; the seed will then germinate quickly. As sainfoin is a quick-growing and deep-rooting plant, the roots keep going down into the moist earth so that dry weather will not have much effect upon it. If sown with a nurse crop, oats, wheat or barley may be used, but the latter is preferable, as it can be harvested earliest. Not more than half the ordinary amount of grain should be sown per acre with this clover, and better results are usually obtained by sowing it alone. It may be sown broadcast, then harrowed in and rolled so as to render the surface smooth, or it may be sown with the ordinary grain drill with grass seed attachment. The seed should be dropped in front of the drill and the land should afterwards be rolled. The small seeds will thus be covered, and, the surface being smooth, the young plants will come up quickly and regularly. For this crop land may be prepared by late summer-fallowing, or, what is even better, the seeding may follow a hoed crop; but, whatever the preparation of the land, it must be clean, and, as the seeds are small, it is essential to have it in a good state of tilth.

This plant has been grown on the experimental plots at the Central Experimental Farm for several years. The oldest plot now living has been standing for seven years, a second plot for two years, and the third plot was sown in the spring of 1903. The plot which has been growing for seven years is now thin and will soon be ploughed down. It would probably be the most economical plan to plough down this clover after three years and resow. As is well known, clovers of all kinds are the most valuable plants which can be grown and ploughed down as fertilizers, and the benefit of ploughing under this clover would more than pay for the resowing.

The Botanist's records of the experimental plots show that Sainfoin sown May 14, came into bloom on August 12 of the same year, was cut for hay on August 25, and gave a yield per acre of 1 ton 1,700 lbs. of cured hay. The second growth of the first year should be allowed to stand over for the winter as a protection to the roots. In the second year the plants came into bloom on June 1st and lasted up till the 24th of that month, when the plot was cut for hay. These dates might have been extended, had the plants been grown merely for honey; but, as they were at that time in the best condition for hay, they were cut for that purpose. If the crop had been left to stand longer, the hay would have been too woody. The yield of this first cutting was 2 tons 200 lbs. of cured hay per acre—a rather small crop, due to the excessive drought, which lasted up till June 12. The second bloom was on July 27, and lasted until August 17, when it was again cut for hay, giving 2 tons 1,400 lbs. of cured hay, or a total yield for the year of 4 tons 1,600 lbs. A third crop, which will provide some pasture, is allowed to remain on the ground for the winter, or in very favourable seasons might be again cut before winter, although this is not advisable.

From what we have seen of this clover, it is believed that farmers and beekeepers would find it profitable to grow it.

## HAY AND PASTURE MIXTURES.

In the last annual report the results of growing several mixtures of grasses and clovers were published. These experiments were again observed during the past season, and the yields given herewith are from the same plots which were sown in 1901. Last season should have been the large crop from these plots; but, unfortunately, the yields were very much lessened by the exceptionally dry weather which prevailed in spring at the time when meadows most require copious moisture. The yields for 1903 are given, together with those of the previous year, for comparison. It will be seen that several of these mixtures give heavy yields of excellent hay, and all of them are worthy of the consideration of the farmers of Canada.

Number.	Mixtures Sown May 4, 1901.		Cured Hay, per Acre.							
			1903.		Total.					
	Grasses.	Clovers.	July 14.		Sept. 30.		1903.		1902.	
	Lbs.	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	2	1,160	1	1,360	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	2	720	1	840	3	1,560	4	660
3	Timothy..... 5 Awnless Brome.... 4 Orchard Grass..... 2	Alfalfa..... 6 Alsike..... 3	2	1,210	1	1,560	4	770	5	120
4	Meadow Fescue.... 6 Orchard Grass..... 2 Kentucky Blue..... 1	Common Red..... 4 Alfalfa..... 3 White Dutch..... 1	2	640	1	1,680	4	320	5	1,520
5	Timothy..... 6 Upright Brome.... 4	Alfalfa..... 6 Mammoth Red..... 4	2	1,320	1	1,520	4	840	4	960
6	Timothy..... 10	Common Red..... 6	1	1,680		1,200	2	880	4	760
7	Timothy..... 10	Mammoth Red..... 6	1	520		1,000	1	1,520	3	1,200
8	Orchard Grass... 18	Alsike..... 5	1	810		1,210	2	080	2	1,200
9	Orchard Grass.... 18	Common Red..... 8	1	1,800		1,800	2	1,600	3	1,280
10	Meadow Fescue.... 20	Common Red..... 8	1	1,320		1,360	2	680	3	40
11	Timothy..... 12	Mammoth Red..... 8	2	280		1,120	2	1,400	3	1,760
12	Timothy..... 12	Common Red..... 8	2	80		1,840	2	1,920	3	20
13	Timothy..... 5 Awnless Brome.... 10	Common Red..... 5 Mammoth Red..... 5	1	1,920		1,920	2	1,840	4	300
14	Awnless Brome.... 25	.....	1	1,360		.....	1	1,360	3	1,020
15	Awnless Brome.... 15	Common Red..... 8	2	40	1	320	3	360	4	760
16	Timothy..... 8	Mammoth Red..... 8	2	480	1	680	3	1,160	3	340
17	Alfalfa..... 15	{(weight green, 8 tons 720 lbs.)}	3	120	1	1,040	4	1,160	3	1,160

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There has been a large correspondence carried on with farmers in all parts of Canada with regard to the best grasses to grow for hay and pasture, and also as to the best crops for late sowing in seasons when drought or other adverse conditions have interfered with the germination or development of corn and other fodder crops. In the drier districts of the West excellent results have been secured from sowing Alfalfa and Brome grass together, 12 to 15 lbs. of the former and 6 of the latter, or mixtures in varying proportions according to the requirements of the growers, of the small grains and some leguminous plant. The mixtures, which have given good satisfaction, are: Tares and oats, a bushel and a half of each, or Peas and oats, in the same proportion; Peas, wheat and oats, one bushel of each; or Peas, wheat and late barley. All of these give heavy crops of excellent hay. A valuable crop which is every day growing in favour, is Fodder Rape. This has been grown with much satisfaction in all parts of Canada. It is best sown alone, two pounds of seed to the acre in drills thirty inches apart, so as to allow of cultivation to destroy weeds and to hold in moisture when the seed has been sown late. Crops of rape are ready for cutting or feeding off in about sixty days after sowing. Two or three crops may be taken before winter sets in.











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