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University of the State of New York

BULLETIN

OF THE

New York State Museum

FREDERICK J. H. MERRILL *Director*

No. 36 Vol. 7

March 1901

16th Report of the state entomologist

ON

INJURIOUS AND OTHER INSECTS

OF THE

STATE OF NEW YORK

BY

EPHRAIM PORTER FELT D.Sc.

ALBANY

UNIVERSITY OF THE STATE OF NEW YORK

1901

University of the State of New York

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University of the State of New York

Museum BULLETIN

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¹ A general account of each, giving life history and habits. Brief records of some of the more interesting facts brought to notice in 1900.



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New York State Museum

16TH REPORT

OF THE

STATE ENTOMOLOGIST 1900

OFFICE OF STATE ENTOMOLOGIST

Albany, 15 Oct. 1900

To the Regents of the University of the State of New York

I have the honor of presenting herewith my report on the injurious and other insects of the state of New York for the year ending Oct. 15, 1900.

General entomologic features. The excessive depredations of last year by the forest tent-caterpillar, *Clisiocampa disstria* Hübn., were somewhat mitigated in 1900, though the insect was present in some orchards in considerable numbers. It is a pleasure to record that the energetic measures employed by various cities and towns last year bore fruit this season in the comparative immunity of these places from the pest. The elm leaf beetle, *Galerucella luteola* Mull., has been kept well under control in Albany and Troy by intelligent and systematic spraying, showing that it is practicable to prevent serious injury by this pest. It has established itself in several localities in the western part of the state, and it may prove as injurious there as it has been in the Hudson river valley. It is a source of deep regret that the commonwealth of Massachusetts has curtailed its operations against the gipsy moth, *Porthetria dispar* Linn. There was every reason to expect the ultimate extermination of this pest on American soil if the work was continued. This insect will now spread over our country, and residents of New York state may soon find it among the insect pests which they will be obliged to fight. This destructive species may appear within our state at any time; and for this reason a brief general account of it has been prepared, that our people may be forewarned. Other insects of interest are mentioned under "Notes for the year."

Office work. There has been a marked increase in the routine office work since last year in spite of every effort to save time along this line. The inspection of nurseries under the direction of the commissioner of agriculture has resulted in the collection of many scale insects, which were referred to this office for name. The determining of these

difficult forms and much of the technical proof reading has fallen on my second assistant, Miss Boynton. The state of Virginia has refused to accept nursery stock under a certificate issued by the state department of agriculture, and the state entomologist has, in compliance with the commissioner's request, issued certificates approving and indorsing the inspection. The large additions to the collection require much time for the proper pinning, labeling and recording of the specimens. Fortunately much of this work can be done by comparatively unskilled labor. The demand for popular information through the press and correspondence has not diminished. During the year 1136 letters, 444 postals, 176 circular letters and 1712 packages were sent through the mails.

Special investigations. Three lines of special work have been prosecuted in addition to minor investigations of insects brought to notice from time to time. 1) A series of experiments have been carried on to determine the best methods of controlling the San José scale in orchards. The results are given under the appropriate title, and in this connection a study of this and related scale insects has also been made, and the results will be presented in a later bulletin. 2) A most promising investigation of the insects injurious to our vast forest interests has been undertaken. 10 days were spent with Dr A. D. Hopkins, of West Virginia, who is a leading authority on the subject, in a study of the insects in the forested mountain regions of that state. Two weeks were spent at Saranac Inn and vicinity and some time in the neighborhood of Albany and also at Manor (L. I.) collecting forms depredating on forest trees. At the last place serious injuries to acres of hard pines have been caused by bark-borers. The results of this work will be prepared for publication shortly. 3) Studies on aquatic insects have been pursued. These are noticed in the following paragraph

Entomologic field station. The aquatic insects of the state are of considerable economic importance, because many game fishes find in them and associated forms a considerable proportion of their sustenance. This field has been comparatively neglected in New York, and therefore it was deemed wise to have some special work done along this line. The museum was fortunate in securing for the summer the services of Dr James G. Needham, of Lake Forest university, Lake Forest (Ill.), who had made a special study of certain aquatic insects and was therefore well equipped for the work. Through the courtesy of the commissioners of fisheries, game and forest, the facilities of the Adirondack hatchery at Saranac Inn were placed at the disposal of my office for this work. Dr Needham was in immediate charge of the station, and was

aided by an assistant of his own selection, Cornelius Betten. They were at the station from June 15 to Aug. 20, during which time they collected many insects, and so far as possible ascertained their life histories. They also gave considerable attention to the conditions under which the various species exist, their relations to each other and their value as food for fishes. The results obtained have amply justified the departure; and in Dr Needham's report, which is nearly ready for the press and will appear as a separate bulletin, there will be found much that is not only new but interesting and valuable.

The work on aquatic insects at Saranac Inn has to some extent been supplemented by studies made in the vicinity of Albany by my first assistant, Mr Banks. The results of this work will be prepared for publication later.

Publications. Several circular letters warning of threatened injuries have been issued and were widely published. The principal publications of the entomologist, to the number of 67, are listed under the usual head. The most valuable of these are the memorial of Dr Lintner, which contains a complete index of his publications, the account of some of the principal insects affecting maples and the illustrated catalogue. A companion to *Insects injurious to maple trees*, treating of those affecting the elm, has been prepared. It will be illustrated, as was its predecessor, by three admirably colored, quarto plates, and it will be published in the report of the commissioner of fisheries, game and forest for 1899. The illustrated catalogue of some of the principal economic insects was prepared to accompany the small traveling collection, which was exhibited at a number of fairs.

Extension work. Considerable time of the entomologist or his first assistant, Mr Banks, was occupied by farmers institutes. They covered a period of 41 working days, during which time about 46 lectures were delivered at the following 24 places: Nelson, West Eaton, Stockbridge, Hamilton, Halcottsville, Lexington, Hensonville, Durham, Breakabeen, Franklin, Esperance, Bethlehem Center, Altamont, Voorheesville, East Greenbush, Gansevoort, Greenfield Center, Burnt Hills, Glens Falls, Fort Ann, East Hartford, Cambridge, Hoosick Falls and Fultonville. In addition, the entomologist has been called upon to give several addresses before scientific bodies.

The traveling collection, composed of some of the more important injurious and beneficial insects, was shown at a number of farmers institutes, and proved an attractive and interesting feature of these gatherings. In this connection, it was exhibited at Altamont, Gansevoort,

Greenfield Center, Glens Falls, Cambridge, Hoosick Falls and Fultonville. The collection was also shown at the meeting of the Western New York horticultural society at Rochester and at that of the Eastern New York horticultural society in New York city. It was shown in addition at the following county fairs: Hornellsville, Cuba, Dryden, and Cobleskill. A part of the expense for exhibiting at these institutes was borne by the management, and the same was true of the fairs.

Collection of insects. The additions to the state collection of insects have been larger than ever before. My assistant, Mr Banks, has spent considerable time in the field collecting forms specially desired for the biologic collection. The contributions from correspondents have been unusually numerous, and by a small cash outlay a large number of specimens were obtained through student collectors. The collecting done at the entomologic field station and also in the study of forest insects has resulted in the taking of many desirable forms. Over 15,000 pinned specimens have been added to the collection during the year, and a vast number of others have been preserved in alcohol. These additions may appear large, but there are still many forms which should be obtained. Dr Needham's work on dragon flies and my studies of forest insects will result in a great enrichment of the state collection in authentically determined Odonata and Scolytidae, besides valuable additions in other groups.

Voluntary observers. This organization has been continued with, I trust, mutual advantages. The work has been extended somewhat, and is now supported by 45 observers representing 42 counties, instead of 43 observers in 39 counties, as last year. Many of those who continued the work begun in 1899 have been able to improve their reports materially, as may be seen by the abstracts given under the proper heading.

Acknowledgments. The entomologist is under obligations to other workers along the same lines for aid rendered. Dr L. O. Howard, chief of the division of entomology of the United States department of agriculture, and his associates have frequently been of service by determining insects or by placing information at my disposal. This central bureau, as at present conducted, should be and is invaluable to working entomologists all over the country. To Dr A. D. Hopkins, entomologist of the West Virginia agricultural experiment station, special thanks are due for personally showing and explaining to me his lines of work and also for his determinations of the Scolytidae or bark beetles and other insects collected by me in the forests. The thanks of the entomologist are also

due to the commissioners of fisheries, game and forests for courtesies extended in connection with the investigations on aquatic insects and to Dr B. E. Fernow, dean of the state college of forestry, for aid in collecting insects at Axton.

It is a pleasure to acknowledge the continued support and encouragement given by the regents during the past year. The work has necessarily been hampered by limited office room, but the much larger and better appointed quarters, soon to be ready, will do away with a number of hindrances.

Respectfully submitted,

EPHRAIM PORTER FELT

State entomologist

INJURIOUS INSECTS

Porthetria dispar Linn.

GIPSY MOTH

Ord. *Lepidoptera*: Fam. *Bombycidae*

This species has attracted more attention in America in all probability than any other imported insect with the exception of the now notorious San José, or pernicious scale. This is somewhat remarkable considering its restricted range in this country, and yet it is not very surprising when due credit is given to the scientists charged with safeguarding the interests of the country. The presence of this insect in enormous numbers at Medford (Mass.) was brought to the attention of Dr C.H. Fernald in 1889, and a special bulletin calling attention to this dangerous pest was issued by the agricultural experiment station at Amherst (Mass.) in November of that year. A study of the situation convinced Dr Fernald that it was not only possible but practicable to attempt the extermination of this species. The past decade has witnessed a wonderful struggle between man and nature, and, had the work received the support it should, there is no doubt as to what the outcome would have been.

There is no occasion for alarm at present. This pest does not occur within the borders of New York state to my knowledge; but, as the commonwealth of Massachusetts has not only declined to do more toward exterminating the pest but puts no efficient checks on its distribution, it is only a question of time when the insect will occasion us some of the trouble it has caused in the neighboring state. It is impossible to say just when this insect will succeed in establishing itself in New

York state. Favoring circumstances may bring about its introduction within a year or two or it may not occur for a number of years. The following brief notice has therefore been prepared in order that citizens of the state of New York may have at hand reliable information concerning a pest they must expect to meet shortly. The well known habits of this species emphasize the value of being forewarned. The extermination of the pest in America may now be placed among the impossibilities, but it is of greatest importance that it be kept under control, as it spreads over the country.

History in America. This insect was introduced into Medford (Mass.) in 1868 or 1869 by Leopold Trouvelot, who imported it in the course of some experiments on silkworms. Justice to Mr Trouvelot compels the statement that the insect escaped from him by accident, and that he did all in his power to repair the mischief. Very little was seen of the creature for about 10 years, and then the caterpillars began to be abundant about the place where they had become established, and from then on their numbers increased till 1889, when Medford and vicinity were literally overrun with hordes of voracious caterpillars. The infestation bordered closely on a plague. An act was passed in the winter of 1890 providing for the appointment of a special commission and placing at its disposal \$25,000, which sum was subsequently increased by an equal amount. The work of that year showed the insect to be present over a much larger territory than had been supposed. A farther appropriation of \$50,000 was made in 1891, and from then till 1899 the appropriations ranged from \$75,000 to \$190,000 annually for the purpose of exterminating this species, the total amount appropriated by the commonwealth of Massachusetts for work against the gipsy moth being \$1,155,000. This is a large amount of money to be expended in exterminating an insect, but it is very small compared to the loss we may reasonably expect from the devastations of this pest. The work was hindered from time to time by delayed appropriations, and yet, in spite of this and other obstacles, good progress was being made in the work of extermination. Its abandonment at this stage can hardly be regarded as other than a grave misfortune. The general results obtained were most striking to a visitor. Places, where in 1891 defoliated trees, crawling caterpillars and signs of desolation had been prominent features, were in 1895 and 1898 seen to be comparatively free from the pests, and the injuries to vegetation slight or none. The checking of the insect over a large area was so thorough as to lead many to forget its earlier destructiveness and to despise its powers. At the close of 1899

the gipsy moth was known to be present in 34 cities and towns in Massachusetts. It has not obtained, so far as known, a foothold in this country outside the state of Massachusetts.

Description. It is exceedingly important that farmers and others in this state shall know something about the appearance of this insect and what to expect. Do not jump at conclusions and consider the specimen a gipsy moth in some form because it bears a general resemblance to the illustrations given herewith. It is much better to send the specimen to an entomologist and secure an authentic determination. Generally speaking, the statement from a non-scientific person that the object in hand is a gipsy moth is of little or no value and is quite apt to be incorrect.

The eggs of this insect are deposited usually in round or oval patches (pl. 1, fig. 8) on a piece of bark and then covered with the buff colored scales from the under side of the female's abdomen. A completed egg mass looks very much like a small piece of sponge. The eggs may be found on stones, in tin cans and in fact on almost any fixed object near at hand, preferably on the under surface, particularly of limbs and fence rails. The nearly globular, pale yellowish or salmon colored eggs are about $\frac{1}{20}$ of an inch in diameter, and there are usually 400 to 500 eggs in a cluster, though occasionally 1000 may be found in an egg mass.

The young caterpillar is slightly over a tenth of an inch long just after it emerges from the egg. It has a black head, the body is brownish yellow and well clothed with long hairs. There is a prominent hairy tubercle on either side of the segment next the head; this gives the caterpillar a peculiar broad-headed appearance, specially in its early stages. The markings become plainer as it increases in size, and, when full-grown, it is from 2 to $2\frac{1}{2}$ inches long and has the appearance shown in fig. 6 and 7 on plate 1.

The somewhat conical, dark brown pupa ranges from $\frac{3}{4}$ to $1\frac{1}{2}$ inches long and is well represented in fig. 5 on pl. 1. It is usually found lying among a few threads and securely attached to them by its terminal spine.

The male and female moths differ markedly. The former, a slender olive brown, black-marked creature with finely feathered antennae and having a wing spread of about $1\frac{1}{2}$ inches, may be seen flying in the late afternoon and early evening in considerable numbers. It is represented with wings expanded and in its characteristic resting attitude in fig. 3 and 4 of pl. 1. The female is much heavier and lighter colored. She has a wing spread of about 2 inches and is of a white or buff-white color with

more or less distinct black markings. The abdomen is tipped with buff. The spread female and her characteristic resting position are well shown in fig. 1 and 2 of pl. 1. The female moth does not fly though she apparently has well developed wings.

Life history. The winter is passed in the egg mass, which is remarkably resistant to atmospheric and other agencies. Experiments have shown that even when the egg clusters were broken up and freely exposed to the elements, the eggs were apparently not harmed, and a normal proportion of the caterpillars appeared at the usual time, which in the vicinity of Boston is from the last of April to the middle of June. The feeding period extends from the first of May to about the middle of July, a caterpillar requiring from about nine to eleven weeks to complete its growth and enter the pupa stage. The young caterpillars remain on the egg clusters from one to five or more days and then commence feeding on the leaf hairs. Soon they eat out small holes in the leaves and, after the third or fourth molt, about as many feed on the edge of the leaf as eat out holes. The caterpillars are nocturnal feeders, remaining in clusters on limbs and trunk or hiding in some crevice during the day, and beginning between 7 and 8 o'clock in the evening leisurely to ascend the tree, where they feed on the foliage at intervals during the night, descending about 3 o'clock in the morning. Many of our farmers are familiar with the masses of forest tent-caterpillars so abundant in sections of New York the past two or three years. The gipsy moth caterpillars assemble in just such masses, and on badly infested trees they are as destructive as our native species.

The larvae transform to pupae during the month of June, the moths appearing from the latter part of June till the latter part of July. In exceptional cases these dates may be considerably extended. Males emerge in advance of the opposite sex, and shortly after the females appear, pairing takes place and egg deposition begins. The embryos are frequently well developed within the egg in two or three weeks after oviposition, but as a rule the caterpillars do not emerge till the next spring. A case is on record of eggs hatching in early September of 1895 at Woburn (Mass.), but the round of life was not completed, and in this northern latitude, at least, there need be little fear of two generations annually.

Food plants. One of the most dangerous features of the gipsy moth is the exceedingly large number of plants on which its caterpillars thrive. They will eat without hesitation almost all our native shrubs and

trees and, when hard pushed, they can subsist for a time, at least, on a number of herbaceous plants. The common fruit trees, the elms, maples and oaks are all eaten most readily, and, even were the list no greater, the pest would be a most serious one to combat. It feeds on many other plants, as the list of 536, given in the exhaustive report on this insect in 1896, attests. It is very true that the caterpillar feeds on some of these only when compelled by starvation, and that it can not be considered an enemy of a number of others, but, even after making most liberal allowance for these, the list is still a very formidable one.

Destructiveness. Countless instances of serious injury by this pest could be given, even if we did not go outside of America. It is well known as a grievous pest in many parts of Europe, and its operations in this country, when unhindered by man, have been appalling. Personal observation of the infested areas in 1891 and later years leads me to consider it a much worse insect enemy than the forest tent-caterpillar. It defoliates forest and other trees just as completely as *Clisiocampa disstria*, and a series of such disturbances of nature may be expected when the insect becomes well established in New York state.

It may be very appropriate to refer, in this connection, to a brief article¹, "On the possible effects of the gipsy moth on American forests," by Prof. N. S. Shaler, of Harvard university, whose opinion should be given great weight on account of his intimate knowledge of the conditions. A brief consideration of the habits of the insect and its effects on forest trees is supported by the following striking paragraph:

For a year the secondary buds of most trees, buds that put forth after the crop of caterpillars has matured, serve to maintain the life of the forest, but the plants are rapidly weakened by the tax, and perish after two or three seasons of the infliction. It appears likely that in five years none of the arboreal forces would survive. Therefore we may assume that, if the gipsy moth becomes firmly implanted in our forests, these forests are in large measure likely to disappear. The processes will probably be slow, for the rate of dissemination of the insect is not great, yet the moths if plentiful will invade railway cars and other vehicles, so that the new colony may be planted at a distance of hundreds of miles from the fields where the species have become abundant.

The concluding paragraph is equally emphatic.

What has been said above may make it plain to the reader that, if the gipsy moth is allowed freely to extend itself in this country, the consequences are likely to become most serious. They may indeed attain to the height of a calamity. It is possible that effective enemies of this species may be developed in course of time, but the past 20 years has failed to show any such. It is possible that some change of climate may

¹ Forester, Sep. 1900, 6 : 206.

reduce or destroy the species, but for more than a score of years they have in no wise suffered from frosts or drouth or excessively wet seasons. It is the part of wisdom to face the issue; we should see that our generation has in this matter no right to trifle with the right of the generation to come. Our forests are next after our fields the natural basis of our prosperity. It is evident that they are endangered by the presence of this enemy.

Means of dispersal. One of the redeeming features about the gipsy moth is the fact, previously noted, that the female moth does not fly. This compels the insect to rely on other agencies to a great extent for its distribution over the country, because, though the partly grown caterpillars are good travelers, they can not, relying on their own efforts, cover great distances. Experience with the insect has shown that people and vehicles constantly passing from an infested area to a clean one are among the most efficient carriers of the pest in the caterpillar stage. The insect can be conveyed long distances in the egg, and it is rather surprising that such has not occurred more frequently. Any hard object allowed to remain near an infested tree during July, while oviposition is in progress, is very likely to be infested with one or more clusters of eggs. The intelligent, energetic officials, who were in charge of the work against the gipsy moth, took special pains to prevent such dissemination, but now that nothing is being done, there is great danger of the insect being carried with household effects to most distant points, specially if packed in boxes and barrels which have been allowed to lie where females could deposit eggs on them. Fortunately for New York state, this pest is most abundant north and northwest of Boston, and with this area we have no direct railroad communication, but as the infestation becomes greater along the line of the Fitchburg railroad and extends to include the terminus of the Boston and Albany line, the danger of the insect being brought into the state will be very largely increased.

Natural enemies. This insect has a number of natural enemies in this country, but unfortunately none of them are aggressive enough to warrant the placing of much dependence on them, though they should be encouraged by all possible means.

Mr Forbush states that about a dozen native song birds are very useful in devouring one stage or another of this moth and that about 25 other species will feed on it to a slight extent, or more largely when their usual food is rather scarce. The most useful birds are the yellow and black-billed cuckoos, Baltimore oriole, catbird, chickadee, blue jay, chipping sparrow, robin, red-eyed and yellow-throated vireos and crow.

A number of predaceous and parasitic insects have either been reared from this insect or observed preying on it, but none of them are of sufficient importance to warrant special mention in this connection.

Recommendations. Investigate anything that arouses a suspicion that it may be the gipsy moth, but be in no undue haste to identify the insect. It will be much more satisfactory to submit the specimens to an entomologist than to arouse unnecessary fears. There have already been several false alarms occasioned by persons with more enthusiasm than discretion, who have attempted to identify an insect with which they were unacquainted.

It would undoubtedly pay to exterminate a small colony, but in the course of time this will be impracticable. We must learn to control it on our own land. The inability of the female to fly and the conspicuousness of the egg masses make this task relatively easy, unless the pest is allowed to escape to the woods. There a private individual could hardly cope with the insect. The point of establishment in this state is almost bound to be near some dwelling, and therefore the species need not be allowed to establish itself in wild land, at least for some years.

One of the most effective methods of keeping this pest under control is the careful collection and burning of the conspicuous egg masses. This can be done most effectually in the fall, during the winter and in early spring. No ordinary fire running over the ground can be relied on to kill the eggs. The only safe way is to put them in a stove or similar fire and burn them up. Creosote oil applied to the egg mass will soak in and kill the eggs. The following preparation was used in the work against the gipsy moth: creosote oil, 5 %; carbolic acid, 20 %; spirits of turpentine, 20 % and 10 % of coal tar. The latter was added to color the compound and thus show at a glance what clusters had been treated.

The caterpillars prefer to hide during the daytime, and advantage may be taken of this habit to tie burlap bands in the middle around the tree trunks and then turn the upper portion of the burlap down over the string. The bands can be lifted daily and the caterpillars beneath killed. This method proved of such great value in the work against the gipsy moth that thousands of trees were banded during the latter part of the caterpillar season.

The insect is quite resistant to arsenical poisons, and it requires a large dose to kill it, specially when the caterpillar is nearly grown. There is probably no better poison for this pest than arsenate of lead, using at

least 5 pounds to every 50 gallons. The application should be made as soon as the leaves are well grown, and then the caterpillars will be poisoned while young and most susceptible to the insecticide.

BIBLIOGRAPHY

A very complete and exhaustive account of this insect in America may be found in the *Gipsy moth, a report of the work of destroying this insect in the commonwealth of Massachusetts, together with an account of its history and habits both in Massachusetts and Europe*, by E. H. Forbush and C. H. Fernald. Many of the facts given in the above account have been taken from this valuable work, which also contains a very complete bibliography of the insect. This work renders a bibliography unnecessary in connection with the above brief notice.

Ypsolophus pometellus Harris

PALMER WORM

Ord. *Lepidoptera* : Fam. *Gelechiidae*

The outbreak of this insect in certain parts of New York state last summer was unusual though not unprecedented. My attention was first called on June 13 by J. F. Rose, voluntary observer for Genesee county, to the serious injuries by this insect. Specimens were sent at this time and also about a week later. The condition of the foliage and young fruit then is well shown on pl. 2, fig. 5. Mr Rose stated that the crop in this orchard of 300 trees was a complete failure, though the trees had bloomed well. He found palmer worms in greater or less numbers in every orchard he visited but one, though as a rule the trees were not so badly affected as in the first. This pest was present in considerable numbers in many of the apple orchards of central and western New York and was the cause of complaints in the vicinity of Albany, where some trees were seriously injured.

Early history. This insect received the popular name of palmer worm in 1791, at which time it was abundant and destructive in New England orchards and forests, particularly in Cumberland county (Me.). Its ravages did not attract notice again for 62 years, when it was exceedingly numerous in all of the New England states and in eastern New York, at which time it came under the notice of Dr Harris, its describer, and Dr Asa Fitch, entomologist to the New York state agricultural

society. The latter was the first to publish a description of the larva, and, as the wrong moth was taken by him to be the parent, his name could not be retained for this insect. The true imago would also have been described by Dr Fitch had not Dr Harris anticipated him by a few days. Describing the damage in 1853, Dr Fitch states that the trees everywhere assumed a brown, withered appearance, looking as though they had been scorched by fire. He was also of the opinion that the widespread denudation of forest trees described by Kalm a century earlier was the work of this pest. The above shows most plainly that the insect may cause great damage, and, as the attack is so much later than that of several of the worst enemies of the apple, there is less chance of the tree being able to recuperate the same season.

Description. The caterpillar is delicate appearing and is represented much enlarged in fig. 1 of pl. 2. It is about half an inch long when full-grown and is then usually of a pale green or a yellowish green color. There is a subdorsal line of dusky color. The head may be either yellowish or black. The larva is quite variable in coloring.

The pupa, pl. 2, fig. 2, is slender and tapers to a spiny tip. It is about one fourth of an inch long.

The moth is quite variable in appearance, as is evident from the number of times it has been redescribed as new (*see* Bibliography p.965). Two of the more common forms are shown in fig. 3 and 4 of pl. 2. The typical form is represented in fig. 3 and that described by Dr Fitch as the comrade palmer worm, *Y. contubernalis*, in fig. 4. It is a delicate, little creature with a wing spread of a little over half an inch. The forepart of the insect is slightly elevated when it is at rest. The original description by Dr Harris is as follows :

Forewings ash-gray, sprinkled with blackish dots, three of which, larger than the rest, are placed triangularly near the middle ; a dusky transverse band near the tips, and a curved row of seven black dots at the origin of the terminal fringe. Hind wings dusky with a leaden luster, black veins, and very long black fringes. Body and legs beneath yellowish white, with a luster of satin. Length from the forehead to the end of the closed wings $\frac{5}{16}$ of an inch. Expansion of the wings $\frac{5}{8}$ of an inch.

Life history. Not much has been recorded concerning the life history of this species. The eggs are unknown. The caterpillars are usually first seen about June 8 and disappear in early July. The little pests evince a preference for the more tender leaves and shoots and they are very active when disturbed. They may usually be found under a few threads of silk or in a sheltering fold of a partly eaten leaf or between

two held together by threads. Jarring of infested limbs will cause them to drop by a thread in much the same manner as do canker worms. Not infrequently a leaf is fastened to an apple, and the caterpillar works into the fruit under its protection. The character of the injury to the foliage and of the irregular holes eaten in the fruit is well shown in pl. 2, fig. 5. The insect pupates normally on the leaves, preferably in the shelter of a folded one, though the pupa may frequently be found with no protection. It is prevented from falling by a few threads spun on the leaf in which its spiny tip is fastened. The moths appear about 10 to 12 days later and undoubtedly hibernate, since Prof. Slingerland has kept them alive nearly to Nov. 1. If such be the case, the eggs must be laid in the spring, possibly on the unfolding leaves.

This insect may be found on fruit trees, preferably apple, and is also credited with being injurious to a number of forest trees. The larva of the form described as *Y. quercipominella* fed on the oak apple, the gall of *Cynips spongifica*.

Natural enemies. Little is known about these beyond the record by Dr Fitch, which states that numbers of these caterpillars are destroyed yearly by a small grub or maggot, which lives within the larva till full-grown, when it leaves its victim through a hole perforated in the side and spins a small, white, oval cocoon, which is commonly slightly attached to the surface of the leaf. Dr Harris observed that about 50% of the caterpillars were killed by this beneficial hymenopteron. It was possibly the same insect which was reared in small numbers from the specimens received from Albion. An example of this parasite was sent to Washington (D. C.), where it was determined by Mr Ashmead as *Dioctes* [*Limneria*] *salicicola* Ashm., a species he described in 1890 from a single specimen reared from a *Gelechia* larva in a willow gall taken in March 1872 at London (Ont.). This species is also known from Texas. The parasite is a minute black, four-winged fly with bright yellow at the base of the antennae, on the under side of the fore part of the abdomen, and rufous legs, which are yellowish at the base. It is about 4 mm long and its grayish white, almost cylindrical cocoon is nearly 5 mm long and 2 mm in diameter (see pl. 2, fig. 7 and 8). Prof. Slingerland reared *Apanteles perplexus* Ashm. M.S., which he thinks may be the form alluded to in 1853 by Dr Fitch, whose description, so far as it goes, applies equally well to both parasites.

Apparently quite resistant to arsenical poisons. The seriously injured orchard mentioned by Mr Rose was sprayed with paris green when the apples were as big as peas and again a week before the

outbreak was reported. It is quite possible that the spraying could have been done more thoroughly in the above cited instance, but the following can hardly be explained away so easily. E. L. Mitchell, Clarkesville (N. Y.) sprayed his trees as follows: before the buds opened with poisoned bordeaux mixture, using one pound of paris green to 100 gallons. This was followed by a spraying just before blossoming, again after the petals had fallen and then after the fruit had attained some size. Arsenate of lead and bordeaux mixture was used in the later sprayings. This treatment killed both the apple and forest tent-caterpillars (the latter were abundant in that section) but not the palmer worms. It is very probable that many of the last-named were killed by the above applications, and that those which escaped were either feeding in the fruit or in the folded leaves; in either of these cases it would be practically impossible to poison them.

Remedies. In spite of the evidence above detailed, this pest should yield to thorough spraying with an arsenical preparation. This will be most effective if applied early in June. The presence of this insect is another reason why arsenate of lead should be used more freely. We should expect the poison from earlier sprayings to remain on the leaves in considerable quantities ready for these later feeders.

Dr Fitch mentions the use of a whale oil soap solution. A liberal and thorough application of this substance would undoubtedly kill many of these and other pests and would also be of some benefit to the trees on account of its fertilizing properties.

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EXPERIMENTAL WORK WITH INSECTICIDES

There has been during the past year a very great demand for precise information as to the best methods of fighting scale insects specially the San José or pernicious scale, *Aspidiotus perniciosus* Comst. Very little experimental work had been done on this insect in New York state before this year, and, as this serious pest had become established in several large orchards in the state, and as some owners were having indifferent success in combating it, the state entomologist was almost compelled to take up this work. This is an exceedingly important matter, because the San José scale has already showed itself not only hardy in our climate but capable of inflicting very serious damage. The eradication of this insect is now an utter impossibility. The corps of nursery inspectors of the state department of agriculture have been doing good work in detecting the presence of this insect and in destroying infested trees. In spite of all this, inspection can not, nor does it attempt to, guaranty absolute immunity from the pest. There is always a chance of overlooking a few scales, and that, taken in connection with the greater chance of receiving scale on stock brought from other states, should render every purchaser very careful as to what and where he buys. The presence of this scale insect in orchards of such extent as to render hopeless the extermination of the pest is a strong indication that many fruit-growers will within a decade be compelled to fight this insect on their own premises or lose their crops. This pest has been established near Albany some eight years or more, and during that period it has succeeded in overrunning a small fruit orchard, where it has killed many currant bushes and a number of trees, besides ruining others. It also occurs on adjoining premises, and has become established over so large an area that, even were this the only infested spot in New York state, which is far from the truth, nothing but the most heroic measures would stamp out the pest. The fruit trees were young, and, owing to the accessibility of the place, it was very good for experimental work in orchards. There are comparatively few trees grown in the vicinity of Albany, and, therefore there is little or no opportunity for work under conditions obtaining in a nursery, though some of the results are as valuable to the nurserymen as to the orchardist.

The experimental orchard is a rectangular piece of ground about 75 by 475 feet. It is a rather light loamy strip extending over a slight knoll and having a southwestern slope toward the Hudson river. The general position of the trees, their size, variety and degree of infestation are

shown on pl. 3. Each tree received a number, which was retained throughout the experiment. Notes on the condition of the individual tree precede the experimental records given under the various insecticides. All the spraying was done with a Gould kerosene sprayer, and the mechanical emulsions were those delivered by this excellent apparatus through a pair of cyclone nozzles.

Experiments with kerosene against San José scale. This insecticide was applied in three strengths, 20 and 25% mechanical emulsions and undiluted. The treatment was given Ap. 11, at which time the buds had not started.

20% mechanical emulsion. 17 trees were treated with this kerosene mixture. Their condition at the time of spraying, Ap. 11, was as follows. Trees 1 and 2 were large apple trees, slightly infested with the scale. The spraying apparatus was not adapted to treating large trees, and these two were included simply because they were in the field, and their treatment was more to keep the pest in check than for experimental purposes. Tree 3, a light oxheart cherry 12 feet high, was moderately infested with the scale. It was a vigorous tree, which had not suffered to any appreciable extent from the pest. Tree 8, a badly infested Lombard plum, was 14 feet high. Its vigor had not been seriously affected by the scale. Tree 9, a badly infested botan plum 19 feet high, was in about the same condition as tree 8. Tree 10, a moderately infested beurre bosc pear, was 12 feet high. Trees 11-14 are seckel pears; the first was about 9 feet high and moderately infested, the others were about 15 feet high and badly infested with the scale. The vitality of none of them had been seriously impaired. Trees 38-39, very badly infested globe peachtrees, were 8 feet high. Tree 40, a badly infested Crawford peachtree, was 10 feet high. Tree 50, a badly infested Idaho pear, was 10 feet high. Tree 51, a moderately infested botan plum, was 10 feet high. Trees 52 and 53 were the same as 51, except that they were badly infested and were 13 feet high. The spraying was as thorough as could be given without having large amounts of the oil and water run down the trunk. The work was done on a sunny, airy day. The next day it rained considerably and this was followed by more rain within a few days.

Ap. 19. Tree 3, the buds are bursting, and little or no kerosene is evident, though the bark is somewhat greasy. Trees 8-14. The kerosene is scarcely evident, and the bark is somewhat greasy. Trees 38-40. The kerosene is hardly evident. The buds are starting, and there are living cigar case-bearer larvae on tree 38, and eggs of the appletree tent-

caterpillar are hatching on tree 40. Trees 50-53. The kerosene is hardly apparent, and the trees are budding.

May 11. Tree 3 is in full bloom (pl. 5), most conclusive evidence that the buds have not been injured by the insecticide. Tree 39 is more backward than 40. The former is much more infested with the scale than the latter. The full bloom of trees 3 and 51 is well shown on pl. 5, 7 which were taken May 12.

May 14. Trees 1, 2, 3, 8-14 are unharmed, the leaves are out well, and the blossoms are numerous. Trees 38-40 are a little more advanced than trees 36 and 37 (treated with 25% kerosene), except tree 39, which is in very bad condition on account of the scale. Tree 50. The leaves are well out, abundant, and the blossoms are about to appear. Trees 51-53. The leaves are nearly out, and the rather abundant blossoms are almost past.

May 28. Tree 39 is in very bad condition, as half of the top is dead, the result in all probability of excessive infestation by the scale. Tree 50 is healthy, the foliage is thick and bright green.

July 2. The young had evidently begun to appear several days previously, as a number were found in the white stage. The trees were all examined for the presence of living young, this being the surest test of the efficacy of the insecticide. Trees 3, 8-14. Young scales are abundant. Tree 38. Living young are comparatively few. Tree 39 had been removed. Tree 40. Living young are numerous. Trees 50-53. Living young are very numerous. This record shows most conclusively that a mechanical, 20% kerosene emulsion will not injure fruit trees when applied just before the buds open, and it also shows, unfortunately, that it does not kill the San José scale under these conditions. The young were produced in such large numbers that it was decided to give a summer application. The vigorous condition of tree 8, photographed on this date, is shown on pl. 8 and is there compared with tree 93, which was photographed the same day.

July 16. This was a dry, very warm, practically clear day and the above listed trees were sprayed with a 10% mechanical kerosene emulsion. There was a breeze most of the time, and the mixture evaporated very rapidly. In subsequent observations account must be taken of this treatment.

July 19. The foliage of these trees was practically unaffected by the insecticide, and a large proportion of the tender young scales were killed.

July 30. On trees 8-10 there were some living young, on trees 11, 12, 14, 38, 40 and 53 most of the scales were dead, on tree 13 only a part of

the scales were dead, and some scales were dead on trees 50 and 52; tree 51 was doubtful.

Aug. 3. Tree 8. The young are abundant. Trees 9 and 10. The young are rather few. Tree 11. The young are somewhat abundant. Trees 12-14. The young are very abundant, and the fruit is badly infested on tree 12. Trees 38 and 40 have some young scales. Trees 50 and 51 are infested by many young, and on trees 52 and 53 the young are extremely abundant.

Sep. 7. The young are very abundant on tree 3, and extremely so on trees 8-14. The young are very abundant on tree 38, and exceedingly so on tree 40. The latter is also true of trees 50-53. Tree 52 is favored with a number of specimens of *Pentilia misella* Lec., the minute ladybug which preys on the San José scale.

Oct. 25. Examinations made at this time show that the insect is still breeding, and that the scale is much more abundant, some trees being almost covered.

25 % *mechanical emulsion*. Four trees were treated with this mixture on the same day and under the same conditions as in the preceding experiment with a 20 % mechanical kerosene emulsion. Their condition at the beginning of the experiment, Ap. 11, was as follows. Tree 23 was a very badly infested Howell peartree about 10 feet high. Tree 24, a Kieffer pear 9 feet high, had few scales on it. Tree 36, a globe peach 12 feet high, was moderately infested. Tree 37 of the same kind was 13 feet high and very badly infested.

Ap. 19. The bark of tree 23 is rough, and the kerosene has soaked in largely. The insecticide is somewhat evident on tree 24, and the buds are starting. Trees 36 and 37 show the presence of kerosene to a slight extent.

May 11. Tree 23 looks hard. The leaves have appeared only near the tips of the twigs. There are many blossom buds. Tree 24 looks fine. The numerous leaves are nearly out and there are many blossom buds.

May 14. Tree 23 is thinly clad with leaves, though they are pretty well out. There are a few suckers and a few blossoms are opening. The leaves of tree 24 are well out and it has abundant blossoms. The many buds and leaves of trees 36 and 37 are starting well but they are not so advanced as in trees 33-35 (treated with 1½ lb. Leggett's whale oil soap to the gallon). The full bloom of tree 24, photographed this date, is shown on pl. 5.

May 28. The leaves on tree 23 are still thin, but the weakness is doubtless due in considerable part to the large number of scale insects on the tree.

June 20. Living scales were found on several of these trees.

July 2. Young scales are rather abundant on tree 23, there are apparently none on tree 24. Few young scales are found on trees 36 and 37.

July 16. The presence of living young on these trees shows that 25 % kerosene emulsion will not kill all the scales on dormant trees. This led to their being sprayed with a 10 % mechanical emulsion under the same conditions as those treated with the 20 % emulsion (*see* under the latter head).

July 19. The foliage was uninjured, and no living young scales were found.

July 30. Practically the same conditions obtained as on the 19th.

Aug. 3. There were comparatively few young on tree 23, and on tree 24 none were found. Some young scales were found on trees 36 and 37.

Sep. 7. Young scales are abundant on tree 23, the leaves of which are partly curled. The tree looks pretty hard. There are very few or no young on tree 24, which is green and vigorous. Young scales are rather abundant on tree 36 and very abundant on tree 37.

Oct. 25. There has been no material change except that the scale is more abundant. Tree 23 is in a very bad condition.

Experiments with undiluted kerosene. It appeared very risky to spray with this substance; consequently the number of trees treated was limited to three. Their condition at the beginning of the experiments, Ap. 11, was as follows. Tree 20 was a very badly infested Bartlett pear 8 feet high. Tree 21 was a very badly infested Howell pear 9 feet high. Tree 107 was another badly infested Bartlett pear 8 feet high.

Ap. 19. The kerosene is somewhat evident on trees 20, 21 and hardly so on tree 107.

May 11. Tree 20 is in a very bad state, but possibly this is due as much to the abundance of the scale, which almost covers the tree, as to the treatment given. The tips of several limbs show a few leaves starting. Many suckers have been thrown out at the base of the tree, and on these the leaves are farther out. Tree 21 is in almost the same condition. It is nearly covered with the scale and looks very bad. The leaves are beginning to appear at the ends of the twigs, and a few blossoms buds are opening. (pl. 4.) The leaves are starting on the tips of some twigs on tree 107 and on its suckers. The suckers on these young trees, 20 and 107, show to some extent how seriously the scales have affected them.

May 14. Tree 20 has only a few tips and the suckers starting. Its condition at this time is represented on pl. 6. Tree 21. The tips of most of the branches bear only a few leaves. There are very few blossoms. Tree 107. The leaves are starting on only a few twigs and suckers.

May 28. Tree 20. Only four small twigs in the top have developed leaves, and these are small. The foliage of the suckers is vigorous, though light. Tree 21. The leaves are rather abundant for a tree treated with kerosene. The top of tree 107 is nearly dead. The foliage of the suckers is rather vigorous.

June 20. There are only a few leaves in the top of tree 20. The suckers were trimmed down to one. The leaves out pretty well on some branches and a number of others are dead. Suckers are being thrown out, and the tree may eventually recover. The top of tree 107 died and was cut off.

July 2. There are apparently no living scales on trees 20 and 107; on tree 21 they are rather abundant. For condition of tree 21 at this time see pl. 4.

Aug. 3. There are apparently no living young on tree 20, and but a few on tree 21. Many living young are found on tree 107.

Sep. 7. The top of tree 20 is dead and the suckers are growing rather vigorously. Young are abundant on tree 21. Tree 107 was cut back, and only the stump remains.

Oct. 25. Even the suckers of tree 20 are in bad condition and appear to be dying back. There are many suckers on tree 21, and considerable scale, but it is not in very bad condition.

Experiments with crude petroleum against San José scale. Considerable has been said in recent months about the value of crude petroleum, and one entomologist has stated, in giving his conclusions regarding its effects on fruit trees, that this substance "is harmless to the most tender varieties and on the youngest trees." This opinion has since been modified, it is only fair to state. Crude petroleum is undoubtedly a valuable insecticide when its use is understood, and when a product with a definite composition can be secured. Very diverse results have been obtained by experimenters with this material, and some of them, at least, can undoubtedly be charged to the difference in composition of the petroleum. Crude petroleum, as now placed on the market, is a mixture of the product of a number of wells, the proportion of oil from each varying with the productivity of the well and influencing the composition of the whole to some extent, at least. The oil used in the

following experiments is such as may be obtained of the Standard oil co., and a sample of it sent to Dr Smith the following December tested but 370 on the Beaume oil scale. Crude petroleum purchased at this time of the same firm and presumably from the same source tested 41.50. The agent asserts this oil to be of fairly constant composition, but that appears to be an open question. It is very probable that we must have a product of more constant composition before the most satisfactory results can be obtained in its use as an insecticide.

Experiments with 20 and 25 % mechanical emulsions and with the undiluted product were tried and the results are detailed below.

20 % mechanical emulsion. This was given a thorough test on 23 trees. Their condition at the beginning of the experiment, Ap. 11, was as follows. Tree 4, a wild cherry 4 feet high, was infested with but few scales. Tree 5, a Crawford peach 12 feet high, was moderately infested with the scale. Tree 6, a Crataegus 10 feet high, was infested with but few scales. Tree 7, a botan plum about 9 feet high, was moderately infested with the scale. Trees 15 and 16, seckel pear, were badly infested, the former 14 and the latter 8 feet high. Trees 17 and 18, an early, unnamed pear 18 feet high, were infested with but few scales. Tree 19, a Bartlett pear 15 feet high, was badly infested. Tree 22, a Howell pear 10 feet high, was very badly infested. Tree 25, a beurre bose pear 8 feet high, was very badly infested. Trees 26 and 27, Kieffer pear 10 feet high, were rather badly infested. Tree 28, a seckel pear 10 feet high, was very badly infested. Tree 41, a Crawford peach 11 feet high, was badly infested with the scale. Trees 43-45 and 47, old Mixon peach between 11 and 12 feet high, were all badly infested, tree 43 being graded as very badly infested. Tree 46, a champion quince 6 feet high, was infested with but few scales. Tree 48, a crab-apple 8 feet high, was infested with but few scales. Tree 49, an abundance plum 10 feet high, was badly infested with the scale.

The spraying with crude oil was under the same conditions as when kerosene was used. It was bright, sunny, airy weather which was followed the next day by heavy rains, and this by more within a few days. The spraying was as thorough as possible without going to the trouble of waiting for the wind in opposite directions, something hardly practicable when the orchard was two miles distant. The treatment was probably more thorough than that with kerosene, because the crude oil is easily seen, and a small area skipped is therefore very apparent, which is not true of kerosene on account of the rapid evaporation of the latter.

Ap. 19. Trees 4-7. The petroleum is well distributed and is quite evident. Trees 15-19, 25-28, 41-49 are about as 4-7 except that the buds are starting, and that the petroleum is very abundant on trees 48 and 49, and is quite evident on tree 22.

May 11. Tree 22 is very hard-looking, but the leaves near the tips of the twigs are nearly out, and there are a number of blossoms opening. Tree 25. One branch has relatively few leaves which are out. The other branches are dead, probably from the effects of the scale, which was exceedingly abundant. This tree was a very bad-looking one to begin with. Trees 26-28. The leaves have started well, and the blossoms are beginning to appear. Trees 41-47. Many of the blossoms have come out, the leaves are appearing. The trees are oily and can be distinguished from the others at some distance.

May 14. Trees 4-7 are apparently unharmed by the petroleum, which shows well. Tree 5 has quite a number of blossoms out and the leaves are just starting. Tree 7. The leaves are well out and the blossoms are nearly past. Trees 15-19. The leaves have started well and the blossoms are numerous, except on trees 17 and 18, which are a different variety. The full bloom and starting leaves of tree 15 are shown in pl. 9. On tree 22 the leaves are rather thin but they are pretty well started. There are only a few blossoms. Several suckers have appeared. The scale on tree 25 was very bad, and the leaves have appeared on but one short branch. Blossoms are nearly out and are abundant on trees 26-28. The leaves are rather plenty and pretty well developed. Tree 41 has many blossoms and small leaves. Trees 42-45 and 47. The numerous buds are partly opened and the leaves are starting. On trees 46 and 48 the leaves are well out. Tree 49. The leaves are about half out and the numerous blossoms are nearly past.

May 28. The leaves of trees 22 and 25 are rather scarce, small and pale. Both trees were very badly infested. Trees 48 and 49 are healthy and the leaves are abundant. Tree 5 presents a ragged appearance, and several limbs have failed to develop leaves.

July 2. There are apparently no living young scales on trees 4-7, 26, 27, 46, 48 and 49. A very few are found on trees 15-19, 28, 29, 41, 42, 44 and 45. They are somewhat abundant or numerous on trees 22, 43 and 47.

Aug. 3. Very few or no living young are found on trees 15-19, 41-49 and comparatively few on trees 4-7 and 22.

Sep. 7. Very few or no living young are found on trees 5, 6, 18, 19, 26, 27, 48 and 49. A few living young occur on trees 7, 16, 17, 25

and 42-46. The young are rather abundant on trees 41 and 47, and are numerous on tree 15, specially on the side next tree 14, which was treated with 20 % kerosene emulsion. The young are abundant on trees 22 and 28, both of which were very badly infested at the start.

A most interesting sight is the hosts of young present on a tree set in between trees 7 and 8 after the orchard had been sprayed. The trunk is almost white with young in places, showing the condition the other trees might have been in but for the treatment.

Oct. 25. There are naturally more insects on these trees than there were Sep. 7. For example, the young are numerous on some of the twigs of tree 28, but, compared with the kerosene-treated trees, their condition is most excellent.

Experiments with 25 % mechanical emulsion. The condition of the trees at the time of spraying, Ap. 11, was as follows. Tree 55, a beurre bosc pear about 10 feet high, was badly infested with the San José scale. Trees 56-61, all seckel pear, were about 14 feet high with the exception of trees 57 and 58, which were about 10 feet high, and were all badly infested with the scale except tree 56, which was moderately infested. Trees 78, 79, globe peach trees, were about 14 feet high. The former was badly and the latter moderately infested with the scale. The spraying varied only from the preceding experiment in the per cent of petroleum.

Ap. 19. The petroleum is very apparent on trees 55-61, 78 and 79, and the buds are starting on trees 56-68, 78 and 79.

May 14. Tree 55 has its leaves pretty well out and only a few blossoms. The leaves of trees 56-61 are pretty well out and abundant, except on the more badly infested trees, 58-61, tree 61 being specially bad. Trees 78 and 79 have abundant leaves about half out and numerous blossoms.

May 28. The leaves of tree 61 are rather thin, but this evidently is due to the abundance of the scale, as the foliage of trees 55-60 is much thicker, and they are fortunate in the possession of much less scale.

July 2. No living young are found on trees 55-57 and but few on trees 58-61. They are rather numerous on trees 78 and 79.

Aug. 3. There are very few or no living young on trees 55-57, 78 and 79 and comparatively few on trees 58-60, and on tree 61 they are somewhat abundant. This tree was in an extremely bad state to start with.

Sep. 7. Very few or no living young on trees 55-57, 78 and 79. Scales are rather abundant on trees 58-61.

Oct. 25. The conditions are practically the same as obtain in those sprayed with the 20 % emulsion.

Experiments with undiluted oil. Four trees were treated with crude oil. The number was limited because it was considered rather hazardous to use this material. The condition of the trees at the beginning of the experiment was as follows. Tree 93, a Lombard plum 14 feet high, and tree 94, a botan plum 10 feet high, were both moderately infested with the scale. Tree 101, a seckel pear 9 feet high and tree 114, a seckel pear 12 feet high, were both very badly infested with the scale. The spraying was done under conditions identical with the preceding. Trees 93 and 94 were sprayed very thoroughly and possibly may have received more oil than the others.

Ap. 19. The petroleum is very apparent on trees 93, 94, 101 and 114, which were well covered. The buds are starting on tree 101. The condition of tree 114 at this time is shown on pl. 6.

May 11. Tree 93 is retarded considerably and has relatively few leaves and blossoms (pl. 7). Tree 94 is killed back to the limbs about one third of an inch in diameter. The buds are just starting. Tree 101 is very backward, the leaves and blossoms are just starting. Tree 114 has only a few leaves appearing at the tips of the twigs. For a photograph of tree 101, taken May 12, see pl. 9.

May 14. The leaves of tree 93 are much thinner and more backward than on adjacent trees. There are few blossoms. Only a few buds are starting on tree 94. All the smaller limbs are killed back. Only a few leaves and blossoms are starting at the tips of the branches of tree 101. A few leaves are partly out at the tips of the branches and but few blossoms occur on tree 114.

May 28. The leaves are out considerably on tree 93, but the foliage is still much thinner than on other trees. The oil is very apparent on the trunk and limbs. Tree 94 has developed one weak leaf. Some twigs are still green beneath the outer bark. There are a very few pale, undersized leaves on the tips of the branches and a few leafless limbs on tree 101.

June 20. The leaves are much thinner on tree 93 than on others adjacent. The lateral buds have suffered most. The petroleum is very evident on the bark. Tree 94 is dead. Tree 101 has only a few bunches of pale green leaves on four limbs and on the suckers. Many of the lateral buds on tree 114 are killed. The shoots are growing well but the foliage is thin. Adventitious buds are developing.

July 2. Trees 93, 101, 114 have a few living young scales. The condition of tree 93 is represented on pl. 8, which should be compared with the other figure, showing the condition of a companion tree,

no. 8, which was treated with 20% mechanical kerosene emulsion. The effects of crude petroleum on tree 101 are well shown on pl. 10. Several limbs on tree 114 have few or no leaves (*see* pl. 10).

Aug. 3. Tree 93 is nearly dead. Dried leaves are hanging from the limbs, though the bark on the trunk is green up to about four feet from the ground. A sprout is starting from the base of the tree, and *Scolytus rugulosus* beetles are attacking it. Tree 101 is developing many suckers and a number of the old limbs are dead. Very few or no living young scale insects can be found on the young wood. There are few or no young scales on tree 114.

Sep. 7. Tree 93 is dead. Few or no young scales can be found on tree 101. Several limbs are dead. There are a few living young scales on tree 114.

Oct. 25. The conditions are nearly the same as on Sep. 7.

The above is a ghastly record for a substance which has been pronounced "harmless to the most tender varieties and on the youngest trees." It was therefore with great pleasure that I availed myself of the opportunity to watch the outcome of several experiments tried by L. L. Morrell, of Kinderhook (N. Y.). Crude petroleum was painted on the trunks of some of the young trees, top-worked with Sutton beauty apples, and later, Ap., the tops of the trees were sprayed with a 25% mechanical emulsion of crude petroleum. Many of the lateral buds in these trees were dead May 21 and the foliage looked sickly. Since then portions of some of the trees have died. Their injury was in all probability caused by the liberal amount of oil put on with the brush. June 20 Mr Morrell reported that the tops of some of these trees had commenced to die, and that a number of them looked sickly. The results of painting a tree-top worked with Sutton beauty with crude petroleum about the middle of February is well shown on pl. 11, which was taken May 21. The foliage was very thin, and the leaves were small and unhealthy. June 2, with few exceptions, they looked well, as stated by Mr Morrell.

The most disastrous results were seen in the king trees painted with crude petroleum Dec. 1, 1899. One was photographed May 21 (pl. 11) and was then nearly dead. June 20 the trees so treated were dead to all appearances.

Experiments with whale oil soaps against San José scale. Two makes of this insecticide were experimented with and the results compared. One was Good's caustic potash whale oil soap no. 3, and

the other was Leggett's anchor brand. The same apparatus was used as in the preceding experiments, and, as the work was done on the same day, Ap. 11, the conditions were practically the same.

Good's whale oil soap no. 3, 1½ pounds to the gallon. Seven trees were treated with this strength of the insecticide on the same day and under the same conditions as in the preceding experiments. Their condition at the beginning of the test was as follows. Tree 29, a globe peach 6 feet high, was badly infested with San José scale. Trees 30 and 31, the same kind and 10 feet high, were infested with but few scales, while tree 32, 14 feet high, was moderately infested. Trees 108 and 109, Bartlett and beurre bosc pear 7 and 10 feet high respectively, were moderately infested, and tree 110, a Kieffer 10 feet high, was rather badly infested.

Ap. 19. Trees 29-32 have a moist appearance. The buds are starting. The soap is hardly apparent on trees 108-110. The buds are starting on 110.

May 11. The leaves are nearly out, and there are many blossoms on trees 108 and 110. The foliage is not quite so advanced on tree 109 and there is no bloom.

May 14. The leaves are starting well and there are many blossoms on trees 30-32. There are no flowers on tree 29. The leaves are pretty well out on trees 108-10. The full bloom on tree 110 is shown on pl. 6.

July 2. There are very few living young on tree 29, apparently none on tree 30, and but few on trees 31, 32 and 108-10.

Aug. 3. No living young were found on tree 29, and a few only on trees 30-32, 109 and 110. Many living young were found on tree 108.

Sep. 7. Very few living young were found on trees 29 and 110, a few on trees 30, 31 and 109, and many on trees 32 and 108.

Good's whale oil soap no. 3, 2 pounds to the gallon. Six trees were treated with this solution. Their condition at the beginning of the experiment was as follows: tree 69, a Howell pear 9 feet high, tree 70, a Clapp's favorite 12 feet high, and tree 71, a Flemish beauty 6 feet high, were all very badly infested with the San José scale. Tree 86, a Crawford peach 10 feet high, was moderately infested with the scale. Tree 87, an old Mixon 12 feet high, was very badly infested, and tree 88, same kind and size as the preceding, was badly infested with the scale.

Ap. 19. The soap is apparent and rather moist on tree 69, while on trees 70 and 71, it is rather dry. The soap is very apparent on trees 86-88.

May 11. Tree 69. The leaves are partly out and there are a few blossom buds. The leaves of tree 70 are farther out and there are many blossom buds. Tree 71 is dead. There are many blossoms on trees 86-88, and the leaves are starting, but trees 86 and 87 are a little later than 88.

May 14. The leaves on tree 69 are half out and rather abundant. The blossoms are few. The tree has been badly injured, probably by the excessive abundance of the San José scale. The leaves are half out on tree 70 and there are many blossoms. The numerous leaves are starting and the bloom is abundant on trees 86-88.

July 2. Living, young scales are very abundant on trees 69 and 70. A few living scales are found on tree 86 and rather few on trees 87 and 88.

July 16. These trees were sprayed with Good's whale oil soap solution as before, except that one pound was used for each five gallons. The day was very warm, practically clear and with a breeze most of the time.

July 30. On tree 69 there are apparently no living scales, and on trees 70, 86-88 most of the young scale insects appear to be dead.

Aug. 3. Living young are rather abundant on trees 69 and 70. There are very few or no living young on tree 86. They are rather abundant on tree 87, and but few on tree 88.

Sep. 7. Living young are very abundant on all this lot of trees, specially on 70.

Leggett's anchor brand, 1½ pounds to the gallon. Six trees were treated with this strength of the insecticide. The conditions and time were the same as in the preceding experiments. Trees 33-35, globe peach respectively 16, 14 and 13 feet high, were moderately infested with the San José scale except the first, which was fortunate in having but few of the pests. Tree 111, a Kieffer pear 8 feet high, was infested with but few scales. Tree 112, a beurre d'Anjou 7 feet high, was moderately infested, and tree 113, a 10 foot pear of the same kind, was apparently free from the scale.

Ap. 19. Trees 33-35, 111-13, have a white, dry appearance, very different from the moist condition of those treated with Good's soap.

May 11. Leaves have started on tree 111, are just starting on tree 112 and are out a little way on tree 113. The buds of all are uninjured, and the trunk and limbs are considerably whitened by the soap.

May 14. There are many blossoms on trees 33-35 and the leaves are starting well. The leaves are out pretty well on trees 111 and 113, and the blossoms are open and very abundant. The leaves are thin and but half out on tree 112 and there are no blossoms.

July 2. There are few living young on trees 33, 34, 111 and 112, and apparently none on trees 35 and 13.

Aug. 3. A few living young are found on trees 33 and 34 and none on trees 35, 111-113.

Sep. 7. Living young are rather abundant on trees 33-35, and none are found on trees 111-113.

Leggett's anchor brand, 2 pounds to the gallon. Six trees were treated with this insecticide. The conditions and time were the same as in the preceding experiments, with the exception of tree 89, as noted below. Tree 72, a Flemish beauty pear 9 feet high, was exceedingly infested with the San José scale. Tree 73, a Howell pear 12 feet high, was very badly infested, and tree 74, a beurre bosc pear 13 feet high, was but moderately infested. Trees 89-91, old Mixon peach trees 10, 12 and 15 feet high respectively, were all badly infested with the scale. There was not enough of the insecticide to spray the whole of tree 89, and a part of it was treated with Good's whale oil soap no. 3.

Ap. 19. Trees 72-74 and 89-91 are nearly white with the insecticide and appear much drier than those treated with Good's soap.

May 11. Tree 72 is dead, evidently on account of the extreme infestation with the San José scale. Old scales are peeling from tree 73, which is still rather white with the soap. Tree 74 is also white with the insecticide. The blossoms of trees 89-91 are opening and the young leaves are appearing.

May 14. The blossoms are open and very abundant on trees 73 and 74 and the leaves are pretty well out. The blossoms and leaves are abundant and starting on trees 89-91.

July 2. Living young scales are numerous on tree 73, and there are apparently none on tree 74. Very few living young are found on trees 89 and 90, and a considerable number on tree 91.

July 16. Trees 72-74 and 89-91 were sprayed with Good's whale oil soap no. 3, 1 pound to 5 gallons. The day was warm, practically clear and with a breeze most of the time.

Aug. 3. Living young scale insects are hardly abundant on tree 73, and there are few or none on tree 74. There are but few living young on trees 89-91.

Sep. 7. Living young are rather abundant on tree 73, and there are but few on tree 74. Living young are extremely abundant on tree 89, and very abundant on trees 90 and 91.

Experiments with a whale oil soap and crude petroleum combination against San José scale. A combination of these two insecticides was tried on 15 trees. The whale oil soap was used at the rate of 1 pound to 4 gallons of water, and this solution was poured into the barrel of the kerowater sprayer. Crude petroleum was put in the oil tank, and the pump set to deliver 10% oil. The mixture was pretty well emulsified in passing through the nozzles. This spraying was done Ap. 20, but otherwise the conditions were the same as in the preceding experiments. The condition of the trees at this time was as follows: Trees 62 and 63, early pear 8 and 12 feet high respectively, were but moderately infested with the San José scale. Trees 64-66, Bartlett pear 14 feet high, were respectively, badly, moderately and very badly infested with the scale. Tree 67, a Howell pear 12 feet high, was very badly infested, and tree 68, a Vermont beauty pear 10 feet high, was quite badly infested. Trees 75-77, the first a Crawford and the others globe peach, respectively 10, 9 and 14 feet high, were infested with but few scales, except tree 77, which was moderately infested. Tree 96, a beurre d'Anjou pear 9 feet high, was infested with but few scales. Trees 97-100, seckel pear 10 feet high, were all badly infested, except 99, which was but moderately infested.

May 11. Tree 67 appears dead, probably from the effects of the scale, as it was very badly infested in the early spring. Tree 68. The leaves are nearly out and there are many blossom buds opening.

May 14. Tree 62. The leaves are vigorous, nearly out and there are a few blossoms. Tree 63. The foliage is appearing more irregularly than in the preceding, some leaves are nearly out and others just starting. The leaves are pretty well out on trees 64 and 65, and the numerous blossoms are open. The leaves on tree 66 are scattering, partly out and there are but few blossoms. The tree is very badly infested. Tree 67 has died, undoubtedly in consequence of severe injury by the scale. The leaves on tree 68 are pretty well out, though rather scattering, and the abundant blossoms are open. The presence of large numbers of the scale accounts for the unsatisfactory condition of the tree. The leaves and buds are just starting on tree 75. The leaves are unfolding and the blossoms are well out on tree 76 (pl. 12). The leaves are pretty well started and the blossom buds are rather few on tree 77. The leaves on trees 96-100 are pretty well out, though rather scarce on tree 96. There are few blossoms on tree 97 and many on trees 98-100. Pl. 12 also shows the condition of tree 98.

May 28. The leaves on tree 66 are rather thin and small and largely at the tips of the twigs. The entire top of tree 67 is dead, but the buds are starting on the trunk.

June 20. Living young scales are found on tree 66.

July 2. A few living young scales are found on trees 62-64, 67, 75, 76, 97 and 98. They are rather abundant on trees 65, 77, 96, 99 and 100, and very abundant on trees 66 and 68.

July 16. Trees 62-68 are sprayed with Good's whale oil soap no. 3, using 1 pound to 5 gallons of water.

July 30. All the scales are apparently dead on trees 62 and 67, and most of them have been killed on trees 63 and 64, some are dead on trees 65 and 66, and on tree 68 the result is doubtful.

Aug. 3. There are very few or no young on trees 62, 63, 67, 75, 97 and 98, and few on trees 76, 77, 96, 99 and 100. Living young are rather numerous on the badly infested limbs of trees 64 and 65 and are abundant on trees 66 and 68.

Sep. 7. There are few living young on trees 62, 96, 99 and 100 and very few on trees 63, 75-77, 97 and 98. They are very abundant on trees 64, 65 and 95 and exceedingly so on trees 66 and 68. The latter was in an exceedingly bad condition last spring. Tree 67 has been cut back to a mere stump.

Fumigation with hydrocyanic acid gas, for San José scale.
A series of tests were made with this substance for the purpose of ascertaining its efficiency and practicability in this latitude. A canvas tent 6x6x8 feet with a fixed pyramidal hood 7 feet high was constructed of 8 ounce duck thoroughly oiled with boiled linseed oil. The rectangular part of the tent was supported on a light, wooden frame in order to reduce the variation in cubic contents as much as practicable. The tent was lifted with a 30 foot pole and an 8 foot gaff, and thus dropped over the tree to be fumigated. The hood was kept extended during the process of fumigation as shown on plate 13, which also illustrates the manner of guying the pole and tent. The tent and apparatus for handling it cost \$38. A number could undoubtedly be made for less pro rata. Prof. W. G. Johnson states that such tents can be procured in Maryland for \$12, which is much lower than any figure quoted in Albany, but probably this would not hold in Maryland since the marked advance in prices. A farmer could get a good pole and gaff from near-by woods at much less than the market price. The bottom of the tent was provided with a sod cloth, a flap some 6 to 8 inches wide, which was covered with earth in order to

prevent leakage of the gas at the bottom. A short, uncovered space was always left, preferably on the windward side, for the insertion of the chemicals, which were put in a stoneware crock. The necessary amount of sulfuric acid was diluted by turning it into the proper amount of water, taking care to keep the water stirred while adding the acid. The crock containing the diluted acid was then placed near the center of the tent but not close to the tree, and the potassium cyanid, previously put in a small bag, was dropped into the acid. The uncovered portion of the sod cloth was quickly buried with earth and the gas allowed to act about 35 minutes. The lines guying the tent were then released, the sod cloth uncovered and the tent quickly raised and dropped over an adjacent tree. It is quite important to have the pole on the windward side of the tent so far as possible, and every precaution should be taken to avoid inhaling the deadly gas.

The trees were fumigated Ap. 19, 20 and 21, using 1 ounce of potassium cyanid to 75, 100 and 150 cubic feet of space respectively. It was planned to fumigate all the trees in one day, but a good breeze and trouble with the outfit compelled the extension of the work over a space of three days.

One ounce of cyanid to 150 cubic feet. Four trees were treated with the gas, using 1 ounce of cyanid of potassium to 150 cubic feet of space. The condition of the trees prior to the beginning of the experiment was as follows. Tree 84, a globe peach 9 feet high, was moderately infested with the scale. Tree 85, an old Mixon peach 12 feet high, was badly infested with the scale. Tree 106, a Vermont beauty pear 10 feet high, was moderately infested, and tree 115, a Bartlett pear 11 feet high, was badly infested.

Ap. 20. Tree 106 was treated. The buds were starting a little. The day was bright, and the exposure to the gas was from 2.35-3.10 p. m. Equal amounts of the cyanid and sulfuric acid were used and thrice the amount of water, the two latter being measured in liquid ounces.

Ap. 21. It was cloudy and still while the fumigation of these three trees was in progress. Tree 84 was fumigated from 9.44-10.19 a. m., using $2\frac{1}{2}$ ounces of cyanid, $3\frac{3}{4}$ ounces of sulfuric acid and $7\frac{1}{2}$ ounces of water. This reaction was perfect as the cyanid was turned from the bag into the diluted acid. The buds were starting a little. Tree 85 was fumigated from 9.02-9.37 a. m., the same amounts of the chemicals being used as with tree 84. The reaction was very poor, only a part of the cyanid being acted on, which was probably on account of the protection afforded by the bag. Tree 115 was fumigated from 10.49-11.24 a. m., using the same amounts of chemicals as on the preceding two.

May 11. Trees 84 and 85 are blossoming pretty fully and the leaves have started well. The leaves are nearly unfolded on tree 106 and there appear to be few blossoms. The leaves are just starting on tree 115.

May 14. The abundant blossoms are out on tree 84, and they have started well on tree 85. The rather abundant foliage is pretty well developed on tree 106 and the blossoms are somewhat abundant. The rather scattering leaves on tree 115 are pretty well out. This last tree was rather badly infested at the beginning of the experiment.

July 2. No living young scales were found on trees 84 and 106 and but very few on trees 85 and 115.

Aug. 3. There were no living young scales to be found on trees 84, 85 and 106, and but very few could be found on tree 115.

Sep. 7. Very few living young scales were found on trees 84 and 115, and but few on trees 85 and 106.

1 ounce of cyanid to 100 cubic feet. Four trees were treated with gas, using 1 ounce of cyanid potassium to 100 cubic feet of space. The condition of the trees prior to the beginning of the experiment was as follows. Trees 82 and 83, globe peach 13 feet high, were both badly infested with the San José scale. Trees 104 and 105, Bartlett pear about 12 feet high, were moderately infested with the scale.

Ap. 20. The day was bright while the trees were being fumigated. The buds of all were starting a little. Tree 82 was subjected to the action of the gas from 11.58 a. m. to 12.33 p. m. Tree 83 from 1.45-2.20 p. m., tree 104 from 9.27-10.03 a. m., and tree 105 from 12.55-1.30 p. m. Equal quantities of cyanid and sulfuric acid and thrice the amount of water were used.

May 11. Trees 82 and 83 show that they will be pretty well supplied with blossoms, and the leaves are starting well. The blossoms are few on trees 104 and 105 and the leaves have not unfolded entirely.

May 14. The leaves and blossoms of trees 82 and 83 are starting well, the latter being abundant. The leaves are pretty well developed and abundant on trees 104 and 105, though blossoms are somewhat scarce.

July 2. No living young scales were found on trees 82, 83 and 105 and very few on tree 104.

Aug. 3. No living young scales were found on any of these trees.

Sep. 7. No living young were found on trees 82 and 104 and very few on trees 83 and 105.

1 ounce of cyanid to 75 cubic feet. Four trees were treated with gas, using 1 ounce of cyanid of potassium to 75 cubic feet of space. The condition of the trees prior to the experiment was as follows: Trees 80 and

81, globe peach 12 feet high, were but moderately infested with the San José scale. Tree 102, a beurre bosc pear 10 feet high, and tree 103 an Idaho pear 13 feet high, were respectively, moderately and very badly infested with the scale. The buds had started a little when these trees were treated.

Ap. 19. Tree 102 was subjected to the action of the gas from 10.47–11.23 a. m. The day was bright.

Ap. 20. Tree 80 was fumigated from 11.58 a. m. to 12.23 p. m., while the sun was partly obscured. Through accident not all the cyanid was turned into the acid.

Tree 81 was fumigated from 11.10–11.45 a. m., and tree 103 from 10.20–10.57 a. m. The sun was bright during both of these treatments. Equal amounts of cyanid and sulphuric acid and thrice the amount of water were used in fumigating trees 81, 102 and 103.

May 11. Trees 80 and 81 will apparently develop a goodly number of blossoms, and the leaves are starting well. There will be few blossoms on tree 103. The leaves are nearly extended.

May 14. The leaves and blossoms on trees 80 and 81 are starting well, the latter being abundant. The leaves are pretty well developed and rather abundant on trees 102 and 103, and on the former blossoms are somewhat scarce, but they are numerous on the latter.

July 2. No living young scales can be found on trees 80 and 103 and but very few on trees 81 and 102.

Aug. 3. No living young scales are found on any of these trees at this time.

Sep. 7. Very few living young are found on trees 80 and 81, none on tree 102 and but few on tree 103.

Conclusions

Kerosene. The experiments with kerosene show beyond question that neither a 20 nor a 25% mechanical kerosene emulsion can be relied on to kill dormant San José scales in this latitude, though either can be used in early spring with comparative safety to the tree. A summer application of a 10% mechanical kerosene emulsion does not injure the trees appreciably, and is a valuable aid in keeping the pest in check, but the treatment should be repeated every 10 days, beginning about June 15 and continuing into September, in order to obtain the best results. The experiments with undiluted kerosene are hardly satisfactory, for the reason that few trees were involved, and these were in bad condition on account of scale injury. The oil did not cause as much injury as was expected,

and it was also not entirely effective in killing the scale. Its use can not be recommended at present.

Crude petroleum. The 20% mechanical emulsion of this substance easily stands as one of the most satisfactory sprays to be used on dormant scale insects in early spring. The trees appear to be uninjured by the insecticide, though possibly a little retarded, while a large proportion of the scales are killed, and on some trees it would appear as though every one had been annihilated. A study of the preceding records will show that all trees treated with this substance and having on them, July 2, enough young to warrant the designation of "somewhat abundant or numerous" were badly or very badly infested with this scale to begin with. That is, each of these trees was literally incrustated in places with the scale, and in the case of those classed as "very badly infested," the incrustation was of considerable extent. It was found to be very difficult to throw enough oil on these places to kill the scale and at the same time avoid injuring the trees. Then some allowance must be made for imperfections in spraying. It is within possibilities to cover a tree with a nearly uniform coating of an insecticide, but in actual practice this is rarely done. It will also be noticed that in spite of some scales being found in early July, they are far from abundant a month later. The infestation is still kept down in early September, though naturally greater than in August. The reinfestation, to some extent, of petroleum-treated trees from adjacent ones is shown by the much greater numbers of living scales found on the side of tree 15, next to tree 14, the latter a kerosene-treated tree literally alive with the young pests. Compared with kerosene, a mechanical petroleum emulsion is a gratifying success. The tests with 25% emulsion do not give markedly different results from those of the more dilute mixture. Scales escaped on the badly and very badly infested trees treated with this as well as with the other. The results are not enough better to warrant the use of the higher per cent of oil. It is a source of great pleasure to state that the extensive spraying of fruit trees infested by San José scale on the estates of L. L. Morrell, Kinderhook (N. Y.) and of W. H. Hart, Poughkeepsie (N. Y.) gave substantially the same results as those above recorded. Mr Hart used an oil obtained from the Frank oil co., Titusville (Pa.). The company states that the oil supplied Mr. Hart ran above 43° on the Beaume oil scale. A sample sent me in February 1901, tests 44.9° and their oil is claimed to run from 44° to 45°. Both of these gentlemen did thorough work and took pains to go over their trees twice, the second time with the wind

blowing in a direction opposite to that in which it blew while the first spraying was in progress. An examination of their orchards Sep. 11 showed that living scales were relatively very few, and that the trees were in excellent condition. The persistence of the oil on the trees for some weeks is unfavorable to the establishment of young scales, and this is undoubtedly a valuable aid in keeping the pests under control.

It will be seen that even after spraying a tree with undiluted petroleum, a few scales may escape, doubtless because the oil failed to reach them for some cause or other. The effects on the trees indicate most clearly the necessity of the greatest caution in spraying with such oil. In fact, it can not be advised. These trees were sprayed at a time when they should be most resistant, and several of them were in full vigor and had been scarcely affected by the pest, and they should therefore, theoretically, be in better condition to withstand the effects of the insecticide. One tree came through the ordeal safely, another lost a number of its limbs and the other two died.

It is true that subsequent experience has led Dr Smith to regard a crude petroleum not testing 43° or over on the Beume oil scale as dangerous to use undiluted. Dr Smith states that a safe oil for use in this manner must not only meet the specific gravity test but it must be either a green or an amber paraffin oil, not an asphaltum oil. The above experiments show that a heavier oil can be used in a mechanical emulsion without apparent injury to dormant trees and the successful control of the scale by Mr Hart indicates that even if the oil be a light one and therefore harmless in its native condition, it is also very effective when diluted. The dilution saves oil, aids in giving a more uniform distribution of the insecticide and as a coarser spray can be used, the work may be done more rapidly. The outfit necessary for making a mechanical mixture is more expensive than an ordinary spraying apparatus but the saving in oil would soon make the difference, if the operations were of any magnitude. An improvement has been made in mechanical sprayers in that the oil and water are conducted in separate tubes to the nozzle, thus preventing the separation of the oil and water in the hose. This device is made by a Canadian firm. A mechanical dilution of crude petroleum is much safer, apparently just as effective and its use is therefore advised.

Whale oil soap. The trees were not injured by the application of this insecticide, even at the rate of 2 pounds to the gallon. They were very thoroughly sprayed, and the scale was undoubtedly severely checked, but the results were not equal to those obtained with a 20 % crude petroleum emulsion. The two treatments with whale oil soap solutions left the trees

in about the same condition regarding scale infestation as the one with crude petroleum. On the other hand, the soap has some value as a fertilizer and is undoubtedly safer to use than even the mechanical emulsions of crude oil. There was little perceptible difference between the 2 and the $1\frac{1}{2}$ pound solutions. The summer spraying with 1 pound to 5 gallons of water proved very effective in killing young scales, but it would have to be repeated at intervals of about 10 days in order to obtain the best results. There was some difference between the behavior of Leggett's and Good's whale oil soap after their application, but the experiment was not protracted enough to permit the detection of a greater insecticide value in one than in the other. Good's soap is more readily soluble than the other, and would be preferable on that account.

Whale-oil soap and crude petroleum combination. This combination gave fully as good results as the whale oil soap solution, but its insecticidal value was not equal to that of 20 % mechanical emulsion of crude petroleum. It is possible that a larger proportion of petroleum could have been used to better advantage.

Hydrocyanic acid gas. Were it not for the excessive cost of tents, specially for large trees, no better treatment could be recommended. In a large orchard of small trees this would probably prove, in spite of the considerable cost of the tents, cheaper in the end than spraying. The trees suffered no discoverable injury beyond the slight browning of a few of the more advanced buds on several trees. The records of these experiments show that fumigation with this gas practically means the annihilation of the scale, even when but 1 ounce of cyanid to 150 cubic feet of space is used. The very few living young scales found on some of the trees could easily have been, and probably were, brought from adjacent infested trees.

NOTES FOR THE YEAR

The season of 1900 has not presented much unusual. The depredations by the forest tent-caterpillar of last year and the year preceding have been continued, and occasionally a new insect has come to notice through its destructiveness to some valued plant. Many dead grasshoppers were found by George Staplin jr, Mannsville, Jefferson co. They had evidently been killed by a fungus, which was determined by state botanist Peck as *Massospora cicadina* Peck, a species which has hitherto been recorded only from the 17 year cicada, so far as known. Say's blister

beetle, *Pomphopoea sayi* Lec., was quite abundant and injurious to the peach trees of E. L. Mitchell, Clarksville (N. Y.) about June 25.

Fruit tree bark beetle (*Scolytus rugulosus* Ratz.) This insect has caused more complaint than usual. It has been reported as causing considerable injury in several commercial orchards in the western part of the state, and its operations in the vicinity of Albany have been more serious than for some years. C. W. Stuart & Co., of Newark (N. Y.) state that most of their young trees injured by *Scolytus* had been previously struck by a cultivator or otherwise damaged. This insect exhibits a marked preference for sickly or wounded trees, but it does not hesitate, when abundant, to attack those apparently in full vigor. At East Greenbush I observed a number of trees where the beetles had begun their preliminary burrows in small peach trees in a young orchard and had deserted them, causing a considerable loss of sap. Quite a number were attacked in this way, and in some the insects continued farther and proceeded to run burrows and deposit eggs. One limb of a peach tree was partly split from the trunk, and the circulation in the bark of the bent portion was undoubtedly weakened. Sep. 7 this place had been attacked by the beetles in large numbers, and the bark was thickly dotted with masses of gum.

Plum curculio (*Conotrachelus nenuphar* Herbst.) This insect was much more abundant than usual at Kendaia, Seneca co., according to reports received from J. F. Hunt. The middle of May they were to be seen waiting on the trees, and by the latter part of the month 50 could be obtained by jarring one tree, and there was an average of 40 curculios for large trees, over 5000 being captured from 200 trees. Fortunately there was an exceptionally large setting of fruit, and even after three fourths was ruined, a fair crop still remained on the trees. It has also been reported as numerous in several other localities.

Pale striped flea beetle (*Systema taeniata* Say). Serious damage by this species to seedling appletrees was reported by two observers. C. H. Stuart of Newark, Wayne co., states that this pest destroyed 20,000 seedling appletrees the latter part of June. The trees were cultivated weekly, and the pests were present in sufficient numbers to strip the young trees within seven days. J. Jay Barden, of Stanley Ontario co., states that this flea beetle was very injurious to seedling appletrees, and that it was also exceedingly abundant on sugar beets. The experience of Mr Stuart with this insect was paralleled last year by that of W. R. Smith, of Syracuse, (*see* N. Y. state entomologist's

report, 1899, p. 538) with a closely related species, *Systema frontalis* Foerst. on sugar beets. The attack of the latter was very sudden, and investigation showed that the beetles existed in large numbers on weeds growing near the beets and from them had invaded the cultivated field. It is very probable that similar conditions led to the attack on apple seedlings this year. It was found comparatively easy to control both species by spraying the infested plants with paris green. The liability of such cultivated crops to sudden invasion by large numbers of these pests emphasizes the necessity of constant watchfulness in order to prevent their causing much injury.

Elm leaf beetle (*Galerucella luteola* Mull.). This insect was not so destructive in Albany and immediate vicinity as in preceding years. This in part, at least, may be attributed to the systematic spraying which has been done for several years past in this locality. Albany was much freer from evidences of beetle injury than Troy, and the elms of the latter place were in a considerably better condition than those of Watervliet. A factor having considerable bearing on the relative injury is the amount of spraying done. It is quite significant that the injury should be the least where it is the rule to spray systematically all the trees on the street, and greater where the spraying must be paid for by the private individual and consequently where only a portion of the trees are treated. The difference between the condition of the elms in Troy and Watervliet must be attributed very largely to the relative amount of spraying done. The American or white elm predominates in the latter city and this species is as a rule eaten by the beetle only when the more attractive European elms have been destroyed. Therefore, other things being equal, it would naturally be expected that Watervliet would be relatively free from the pest, and the reverse of this can hardly be considered as due to any other cause than the lack of spraying.

This pest has been definitely located at several important points during the year. It was found to have been present in considerable numbers at Hoosick Falls, Rensselaer co. It has also established itself pretty generally in the towns of Stillwater, Schuylerville, Salem and probably at Greenwich. The presence of the insect at Salem indicates the possibility of still farther progress north, but there are good reasons for thinking that the insect will not be very injurious, excepting possibly in an unusual season, north of Mechanicsville. The occurrence of the pest at Oswego, Hastings and Rochester, first brought to my notice through Dr L. O. Howard, is a much more serious matter. Prof. C. S. Sheldon states that he has examples of this insect taken at Oswego in 1896, and Prof. M. H.

Beckwith states that it has been for several years at Elmira, Chemung co., in considerable numbers. Central New York is a region where the pest may be expected to flourish as well as it does in the Hudson river valley. It certainly should be carefully watched, and steps taken, if necessary, to prevent the serious damage inflicted on the elms in the eastern part of the state.

Gold gilt beetle (*Chrysochus auratus* Fabr.). This species lives by preference on the spreading dogbane, and, though there are accounts of the beetle attacking other plants, they are probably erroneous or the insects may have been driven by hunger to feed on a plant otherwise unmolested. The adult is a beautiful greenish gilt insect which is quite common in July in the vicinity of spreading dogbane. The egg capsules are very interesting. They have been previously described in the *Journal of the New York entomological society*, 3: 192, by Rev. J. L. Zabriskie, but, as the account has been overlooked by many and

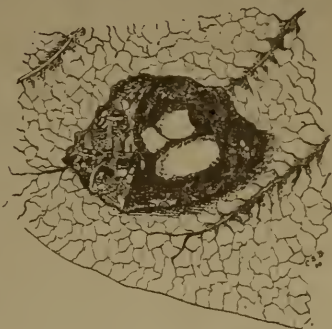


FIG. 1. Egg capsule of *Chrysochus auratus* broken open to show eggs (original).

is not accessible to others, a few notes are given at this time. The egg capsules are black, conical masses occurring usually on the under side of the leaves. They are pyramidal in shape, about 2 mm in diameter at the base, nearly as high, and one may contain three or four eggs, fig. 1. Each egg is $1\frac{1}{2}$ mm long, .5 mm in transverse diameter and of a yellowish white color. The egg shell is soft and its surface moist. The covering capsule is quite firm and is composed of the excrement, or frass, of the beetles stuck together with a glutinous secretion. The purpose of this singular covering is undoubtedly as much to protect the eggs from the drying influences of the atmosphere as to shield them from insect and other enemies. The larvae drop to the ground and live at the roots of this weed, it is stated.

12 spotted asparagus beetle (*Crioceris 12-punctata* Linn.). The distribution of this species has been noted as occasion has offered. The following are additional to the localities recorded in my previous report. Miss Harriet M. Smith sent specimens from North Hector, Schuyler co., and R. H. Darrison took the insect at Lockport, Niagara co. It was also received from Fred Warren, Pike, Wyoming co. It was reported as present at Fredonia, Chautauqua co., and at Almond, Allegany co., by J. Jay Barden; and Dr Howard has informed me of its

presence at Penfield, Monroe co. Mrs E. B. Smith brought in a specimen from Coeymans, Albany co., and I took it at Manor, Suffolk co., where it was present in greater numbers than the common asparagus beetle, *Crioceris asparagi* Linn. The above, in connection with records previously given, is pretty good evidence that this species has already attained a wide distribution in this state.

Grain beetles in a new rôle. Last October two insects, which proved to be *Silvanus surinamensis* Linn. and *Cathartus gemellatus* Duv., were received from C. L. Williams, of Glens Falls, with an inquiry about their habits. In a large collar and cuff factory considerable annoyance was occasioned by the appearance of rust-like spots in the lining of the finished products, specially the collars. These two beetles and what appeared to be the partly crushed fragment of a wing cover were all that Mr Williams could find of anything that might be responsible for the trouble. Subsequently spotted examples of such linen were sent to me for inspection. The rusty color was evident on the outside, and in the lining small rust-colored specks could be seen that under a microscope appeared to be of organic nature. The various processes through which the linen had been put, worked the stain into the corner of the collar and also macerated these bits so effectively that they presented simply the appearance of abraded atoms. Mr Williams states that there is no stain on the cloth before it is made into collars, only here and there a small speck which seems utterly incapable of producing the amount of stain obtained. The trouble occurred over a period of six weeks, during which time dozens of collars were ruined. It seems very possible that these insects occurred in small numbers in the collar linings, attracted there by the farinaceous matter, and that the stains came from the fragments of their bodies.

Snakeworm (*Sciara* species). These remarkable assemblages of *Sciara* larvae are worthy of note, and it was therefore a source of considerable pleasure to receive from C. A. Chamberlain, Franklin, N. Y.) examples of *Sciara* larvae from one of these peculiar snake-like masses. It is a source of great regret that none of the insects could be carried through to maturity. The specimens were sent under date of July 23 with the following details. The larvae were observed in their peculiar, snake-like formation, crossing a sidewalk from a lawn they had evidently left. They made little headway when separated but progressed very well in the mass, moving from three to four feet an hour. The following additional matter was given in response to queries. The larvae all appeared to come from under stones, as none were found in the grass,

and they were to be observed crossing the walk in the morning or the latter part of the night. One or two strings of them were found on mornings of several successive days. These strings or masses were 12 to 20 inches long and with a depth of 10 to 12 larvae at the head, tapering down to a small tail rarely composed of more than a single layer of insects. They were seen in but one place near a well kept lawn, which had been liberally manured in the spring. They kept in the shade of trees and, when exposed to the sun, succumbed in two to three hours. It is a pleasant duty to place on record these interesting observations so willingly communicated by Mr Chamberlain.

It is well known that *Sciara* larvae live in decaying vegetable matter, and it is probable that the masses observed by Mr Chamberlain had lived in the lawn and were impelled by some cause or other, possibly the desire to find a more favorable place for undergoing their final transformations, to forsake it when about full-grown. These tender, moist larvae are very susceptible to sun and dryness, and their peculiar method of progression reduces these perils very largely. It should be noted that the head of this snakeworm, literally worm snake, had a depth of 10 or 12 insects, showing that these larvae were crawling over each other, and hinting at the method of forming such a curious body. Such insects naturally prefer to crawl over a moist surface, and a cause leading to the common movement of a large number would most probably result in one larva crawling over another, and an aggregation of a few would attract others. Thus the natural law which leads animals in many cases to move along lines of least resistance would account for the formation of these masses. The direction taken in the migrations would be determined largely by the primary leaders. A line once established would naturally progress in the original direction unless prevented by an obstacle. These assemblages are remarkable, but they can be explained as the normal result of certain causes, and there is no necessity of assuming that the individuals possess some unknown sense or intuition.

These peculiar aggregations have been known in Europe for many years, and there are some interesting superstitions in connection with them. They are known under the names of *Heer Wurm*, army worm, and in Norway as *orme drag*. Snakeworms 10 to 12 yards in length have been noticed, and M. Guérin-Méneville records columns 30 yards in length. The European species possessing this habit has not been determined positively, but it passes under the name of *Sciara thomae* Linn. or *S. militaris* Now., probably the latter according to Baron Osten Sacken.

There are several records of the occurrence of snakeworms in this country, but detailed observations are wanting in most cases, and in none has the species been identified to my knowledge. Prof. F. M. Webster records in *Science*, Feb. 23, 1894, 23:109, two instances in which he observed snakeworms after heavy rains, and he is of the opinion that in these cases the larvae were driven by water from their usual haunts.



FIG. 2 Larva of *Sciara coprophila* Lintn. (after Lintner).

The larvae, like others known to belong to the genus *Sciara*, are legless, whitish and with black heads. The specimens received measured 6-7 mm long. The accompanying figure, 2, which represents the larva of *Sciara coprophila* Lintn., gives the general appearance of the species under consideration. The diagram given in



FIG. 3 Diagram of clypeus and punctures of snake worm (original).

fig. 3, represents in outline the clypeus of the snakeworm larva and the general arrangement of the punctures on it and in its immediate vicinity. A comparison with a similar diagram¹ of the punctures on and near the clypeus of *Sciara coprophila* will show a marked difference between the two.

Forest tent-caterpillar (*Clisiocampa disstria* Hüb.). The depredations of this pest in 1898 and 1899 gave rise to well grounded fears that it might prove destructive this year. Examinations of sugar maple trees during the winter of 1899-1900 showed that the egg clusters of this species were present in large numbers in some localities. The following records of these observations give an idea of the conditions prevailing in various sections of the state. At Nelson, West Eaton, Stockbridge and Hamilton, Madison co., many of the sugar maples were abundantly supplied with egg clusters of this pest. At Durham, Greene co., and Franklin, Delaware co., egg clusters were present in considerable numbers on some maples. One small maple at Durham had at least 25 egg clusters; on one small twig there were eight, four being placed end to end. Some badly infested trees were found at Esperance, Schenectady co., and at Albany, Altamont and Voorheesville, Albany co. At Greenfield Center and Burnt Hills, Saratoga co., Glens Falls, Warren co., and Fort Ann and Cambridge, Washington co., some trees were pretty well stocked with eggs. At Hoosick Falls, Rensselaer co., a number of maples were badly infested. One small one had 50 egg

¹ Lintner, J. A. 10th rep't New York state entomologist. 1894, 95. p. 395, fig. 5e.

clusters on it, but this was evidently in excess of the average. At Cooperstown, Otsego county, 300 egg belts were taken from one maple, as reported in the *Country gentleman*. At Glen, Montgomery co., and Plattsburg, Clinton co., these eggs have been reported by correspondents as occurring in large numbers. The maple and appletrees at Oneonta, Otsego co., were literally loaded with egg clusters, as stated by L. I. Holdredge. It certainly looked as if the widespread defoliations of the previous year were likely to be repeated, specially as similar reports were received from many others. The egg belts of this insect are very resistant to insecticides. Young caterpillars were observed to hatch from a cluster on a twig which had been thoroughly painted with crude petroleum the preceding December. The eggs remained on the tree over winter. Egg clusters dipped in crude petroleum Ap. 9 failed to produce any caterpillars, but such radical treatment is ordinarily out of the question.

There was a period of unusually cold weather in early May, and at this time a report started from Middletown, Orange co., to the effect that the young forest tent-caterpillars were killed in large numbers by the severe weather. This was a matter of considerable economic importance; and therefore the voluntary observers were requested to make a special report on the effects of the cold on the young forest tent-caterpillars. Reports received from about 30 observers, located in as many counties, stated that, while apparently many of these caterpillars had been killed, in reality they were in a dormant condition, and that during the warm weather following they appeared in numbers and fed most voraciously. At Delhi, Delaware co., F. M. Simpson found considerable numbers dead and was inclined to hold the weather responsible for the mortality. Many dead caterpillars were found by J. M. Dolph, Port Jervis, Orange co., and by C. E. Childs, Mayfield, Fulton co. A. J. Meiklejohn, Plattsburg, Clinton co., gave a detailed account of stiffly frozen tent caterpillars reviving after being brought into a warm room. The cold weather probably killed numbers of the pests in some sections, but in Albany, Chemung, Greene, Saratoga, Seneca, Wyoming and Yates counties their prevalence equaled or surpassed that of the previous season. A remarkable feature about the outbreak, specially in orchards, was the apparent absence of the pests till late in the season, when suddenly they were observed in large numbers and quickly stripped the trees. These pests were not seen in one orchard in East Greenbush till June 3, and by the 6th the thrifty young trees were partly stripped, and the caterpillars were present in enormous numbers, fairly covering

large portions of the trunks and limbs of the unfortunate trees. Plate 15 shows the condition of the trunk and lower limbs and plate 16 is an enlargement of a portion of the preceding and gives a better idea of the number of caterpillars. This outbreak occurred in a large orchard of vigorous, fair-sized trees. It was not far from a small piece of woods, but the hosts of caterpillars had evidently not invaded the orchard from the forest. They came from eggs laid on the trees, and their hatching had probably been delayed by the period of cold weather above mentioned. This late, sudden outbreak occurred in a number of orchards.

An injury out of the ordinary was reported by E. L. Mitchell, Clarks-ville, Albany co. His red and blackcap raspberries suffered severely from these pests, the caterpillars crawling from the adjacent woods and stripping the leaves from the plants in the nearest rows, working on them much as the army worm does when it invades a grain field. The pests were present in such large numbers as to threaten the defoliation of a large part of eight acres of berry bushes.

The abundance of these caterpillars afforded an excellent opportunity for experimentation with contact insecticides. Good's caustic potash whale oil soap no. 3 and his tobacco whale oil soap were tried, each at the rate of 1 pound to 5 and 1 pound to 10 gallons of water. The caterpillars were thoroughly sprayed as they were clustered on the trunks and limbs, and about 15 minutes later samples of the victims were put in cardboard boxes for subsequent observation. The stronger solution of tobacco whale oil soap killed within a few days a considerably larger portion of the caterpillars than the other.

The record is as follows:

Good's whale oil soap no. 3, 1 pound to 5 gallons

- June 8. 99 caterpillars dead, 62 living
- 9. 6 caterpillars dead
- 15. 16 caterpillars dead
- 19. 10 caterpillars dead : 81.3% of the total killed

1 pound to 10 gallons

- June 8. 87 caterpillars dead, 65 living
- 9. 5 caterpillars dead
- 15. 23 caterpillars dead
- 19. 14 caterpillars dead : 84.8% of the total killed

Good's tobacco whale oil soap, 1 pound to 5 gallons

- June 8. 135 caterpillars dead, 41 living
- 9. 5 caterpillars dead
- 15. 20 caterpillars dead
- 19. 4 caterpillars dead : 93.18% of the total killed

1 pound to 10 gallons

- June 8. 110 caterpillars dead, 105 living
- 9. 29 caterpillars dead
- 15. 6 caterpillars dead
- 19. 10 caterpillars dead: 72% of the total killed.

The experiment was continued to the end, and the caterpillars not killed developed 34 parasites, 20 male and but eight female moths, and a number died in their cocoons from some other cause. No moths developed from those sprayed with the stronger solution of tobacco whale oil soap. This latter soap appears to be much more effective for this kind of work than the ordinary preparation. Experience emphasized the necessity of thoroughly drenching the caterpillars with the insecticide, if the best results were to be obtained. A moderately fine spray was much more economical of the solution and gave better results than a very coarse spray.

This species was attacked by a large number of parasites, and in some localities the pests were nearly exterminated in limited areas. A lot of 100 cocoons were collected at Slingerlands (N. Y.) June 28, and the natural enemies of this species bred from them. 46 parasites were obtained, 21 of which were either *Pimplas* or *Theronia fulvescens* Cress., a secondary parasite and an enemy of the *Pimplas*, and a considerable proportion of the remainder belonged to the *Tachinidae*. The thoroughness of this parasitism was strikingly shown by a lot of cocoons from Altamont submitted for examination by Judge J. W. McNamara. Over 90% had been killed by parasites. *Pimpla conquisitor* Say and *P. inquisitor* Say were the two most abundant and effective parasites in many localities. The females were present in considerable numbers at Slingerlands, and could be seen investigating the cocoons and occasionally thrusting the ovipositor through the meshes. *Theronia fulvescens* Cress. was almost as numerous as either of the two preceding species. It was taken at Slingerlands, and also reared from cocoons received from Glens Falls. *Anomalon exile* Prov. was reared in smaller numbers from cocoons received from Lyon Falls and Glens Falls. *Pteromalus vanessa* How. was reared in considerable numbers from cocoons collected at Glens Falls. *Tachina mella* Walk. was a valuable parasite in many localities, and a large number of flies could have been reared. The latter part of June, when the forest tent-caterpillars were crawling everywhere, one was attacked by a common wasp, *Polistes pallipes* St Farg. Two wasps were engaged in the battle. They cut the caterpillar in two, and one began feeding on a portion, while the other hung around, evidently anxious to get at the delicacy. A

hyperparasite, *Dibrachys boucheanus* Ratz. was reared from material received from Glens Falls (N. Y.) It probably attacked *Pimpla inquisitor* Say.

The effects of a windstorm at Slingerlands on this insect while it was in the pupa stage is worthy of record. June 29 and 30 there was a storm with a maximum wind velocity of 26 miles an hour, this being the record at Albany, only seven miles distant. The wind tore hundreds of cocoons from their fastenings and strewed them over lawn and field, giving in places almost the effect of a light fall of snow. It is not likely that the wind killed many of the insects within their cocoons, but it brought them within easy reach of natural enemies, and a heavy rain would probably have destroyed many of the pupating insects. Two days later, July 2, moths, principally males, were very abundant. They flew about the apple-trees literally as thick as bees in the late afternoon and early evening. The caterpillars had been somewhat of a nuisance earlier in the season, but the moths were worse, at least for those wishing to enjoy the shade and coolness of the trees, on account of the ejected pinkish fluid which gummed and stained clothes in a very annoying manner.

Fall army worm (*Laphygma frugiperda* Abb. and Sm.). This insect was very abundant and destructive in Buffalo and vicinity last fall. M. F. Adams of that city reported to me that he found large patches in many lawns entirely destroyed in one section of the city. The grass on one large lawn had all been killed except a little on the front portion, it having been entirely eaten and nothing remaining but weeds. The most serious damage appeared to have been caused by the larvae cutting off the grass just below the crown, thus destroying it. The pest evinces a decided preference for blue grass, and, as that constitutes a large proportion of the lawns in Buffalo, they suffered accordingly.

Red-banded leaf-roller (*Lophoderus triferana* Walk.). The depredations of this insect on green pop-corn were brought to my attention by C. H. Stuart, Newark (N. Y.) in July 1899, when several of the light green caterpillars were sent with the statement that they had attacked about 27 % of the crop, 37 % of the corn on each infested ear being destroyed. A larva was sent to Washington (D. C.), but the authorities there were unable to identify the pest till the moth appeared in February 1900. This is one of the cranberry worms which cause trouble in Massachusetts. It has been recorded as feeding on elm, soft maple, oak, apple, rose, bean, *Gnaphalium polycephalum*,

clover, strawberry, osage orange and salsify, besides the plants previously named. Its variable food habits render its control more difficult. Prof. Forbes, in his 3d report on the insects of Illinois, records it as a leaf-roller occurring in May and June, evidently in small numbers, on young corn, the adults appearing the last of June. The attack in this state was different and apparently limited largely to the green corn on the ear, a place where it would be very difficult to employ any adequate remedial or preventive measures. There are probably two generations annually, the moths from the earlier larvae appearing the latter part of June and those from the later ones hibernating and disclosing the adult in the spring.

Harlequin cabbage bug (*Murgantia histrionica* Stal.). Through Dr Howard I received records of the presence of this species at Jamaica (L. I.), New York, and Oswego. The occurrence of the pest at the last place is believed by Dr Howard to be largely accidental, that is, that it was probably brought in from some other point by shipments of its food plant, and that it could hardly exist there for a series of years. This insect has recently been taken in small numbers at Elmira (N. Y.) by Prof. M. H. Beckwith. This record is of considerable interest as indicating the existence of this bug at other points in the state and in some measure justifying the expectation that this species may be able to sustain itself in limited numbers, at least, in parts of western New York. It is a serious pest of the cabbage crop farther south; and it is to be hoped that the severity of our climate will always prevent this species from becoming abundant enough to cause material damage.

Juniper plant bug. (*Pentatoma juniperina* Linn.) Several living examples of this insect were received June 28 from Miss E. A. Blunt, of New Russia (N. Y.) One oviposited in transit; and the eggs are herewith described. They are deposited upright in regular rows and are subcylindric with rounded ends. The ground color is a light chocolate brown, with a central, rather broad apical ring of a white, finely granulated matter; a thinner, larger ring of the same material, ornamented with minute, irregularly placed spinules, defines the cap pushed off when the young emerges. The sides of the eggs are also more or less covered with this white substance, which appears to peel irregularly to some extent. The egg shell is finely punctured. The eggs are a trifle over 1 mm high and a little less in diameter.

Elm bark louse (*Gossyparia ulmi* Geoff.). This pest holds its own in Albany, Troy and vicinity and it occurs on a large proportion

of the elms in these places. Pseudimagos were very abundant on infested limbs May 10, and on the 21st perfect winged males appeared in large numbers. There was an interval of several days between these two dates when no males could be found.

This pest is evidently making its way over the state, as its reception from Flushing (L. I.), and Ogdensburg, St Lawrence co., and its detection at Greenwich, Washington co., would imply. It has probably established itself in many cities and villages in New York state.

Grasshoppers. These insects are always present in some numbers, but in the summer of 1900 certain species were abnormally abundant and destructive. Two species, the red-legged grasshopper, *Melanoplus femur-rubrum* De Geer, and the Carolina locust, *Dissosteira carolina* Linn., were specially abundant in a section of Rensselaer county extending from Castleton through Schodack, Sandlake, Poestenkill, Brunswick and Pittstown townships. They occurred in countless millions, as stated by Mr Hitchcock, voluntary observer in that county. So serious was the evil that many farmers cut their oats in order to save them, and even then found that most of the grain lay on the ground. In two instances fields of buckwheat were entirely destroyed. The lesser migratory locust, *Melanoplus atlantis* Riley, was a very abundant species at Karner last July. Grasshoppers occurred in immense swarms at Mayfield, Fulton co. They were so abundant as soon to devour a piece of oats, as reported by voluntary observer Childs. They were also reported as very numerous at Ogdensburg, St Lawrence co., by Miss Sherman; and I found certain species excessively abundant at Saranac Inn and vicinity, Franklin co.

VOLUNTARY ENTOMOLOGIC SERVICE OF NEW YORK STATE

The work of last year has been continued, and a large number of valuable observations have been put on record. The two tent-caterpillars have been very abundant in a part of the state during the past season, and most of the observers have given considerable attention to these pests. The report, started early last spring, that the unseasonable, cold, wet weather had destroyed large numbers of the forest tent-caterpillars, was brought to the attention of each observer, and special observations were requested. The entomologist was in a few days in possession of a mass of facts bearing on this question. These records were made by conservative, trustworthy persons located in all sections of the state; and,

while in some places it appeared that cold and wet actually did kill many of the caterpillars, it was the opinion of most that fatalities were comparatively limited, and several observers demonstrated that the recently hatched caterpillars were very resistant to climatic influences.

Some of the records may appear trivial, but a life history is nothing more than the sum of many small facts. The value of the records relating to the appearance and relative abundance of the different insects will increase with the length of the period over which they extend. These records will also show in time the effects on insect life of the different climatic conditions in the various sections of the state.

Summaries of reports from voluntary observers

The names inserted in brackets indicate determinations made by the entomologist. The others are presumably correct except where questioned. The dates given after the records are those of the reception of the reports, and they are from one to three days later than the writing of the report.

Albany county (E. T. Schoonmaker, Cedarhill)—Appletree tent-caterpillar [*Clisiocampa americana*]. Egg clusters are abundant and the prospect is that the caterpillars will be numerous. Ap. 17. They have already formed small nests or webs. May 1. Fiery ground beetles and June bugs are exceptionally numerous in cultivated fields. Appletree tent-caterpillar work is beginning to be apparent. Elm leaf beetles [*Galerucella luteola*] are to be found in buildings, but they have not attacked the young foliage. May 8. Appletree tent-caterpillars were very active on Wednesday and had suffered no noticeable injury from the hard freezes. They were dormant on cold, cloudy days and on warm days active. There were no signs of injury to either species of tent-caterpillars, though the thermometer stood at 27. June bugs were present in exceptionally large numbers the evening of May 12. May 15. Forest tent-caterpillars [*Clisiocampa disstria*] are stripping apple, plum and maple trees, though they were not injurious in this locality till the present season. They are gathering in bunches of hundreds on the limbs or spin down on webs. May 28. Potato beetles [*Doryphora 10-lineata*] have appeared in small numbers. Forest tent-caterpillars are still doing some injury. Rhubarb curculios [*Lixus concavus*] are injuring rhubarb to some extent in limited sections. June 5. Rose beetles [*Macrodactylus subspinosus*] have appeared and potato beetles are abundant. Forest tent-caterpillars

are spinning their cocoons. June 12. Forest tent-caterpillars are still spinning their cocoons, many trees have been defoliated by them. Eggs of the elm leaf and potato beetles are hatching in limited numbers. June 19. Potato beetle grubs are very abundant, the forest tent-caterpillars have all disappeared. June 26. Potato beetles are very numerous and destructive. Elm leaf beetle larvae are nearly full-grown. Fall web worms [*Hyphantria cunea*] are numerous on apple trees. Both house fly [*Musca domestica*] and horn fly [*Haematobia serrata*] are very numerous and annoying. July 10. Grasshoppers are exceptionally abundant. Adult elm leaf beetles have appeared. Aug. 7. Grasshoppers are now feeding on late planted corn, the meadows having turned brown from the drouth. Green cabbage worms [*Pieris rapae*] are exceptionally numerous, some plots being ruined by their ravages. Elm leaf beetle has apparently disappeared with the first brood. The work of this insect on unsprayed trees was as bad as last year, if not worse, American elms suffering as much as the European species. This insect has not spread to elevations 200 feet above the Hudson river. Sep. 11. Cabbage worms are doing serious damage to the crop, nearly destroying many large plots. Oct. 9.

Broome county (J. Mace Smith, Binghamton). Appletree tent-caterpillars [*Clisiocampa americana*] were seen for the first time Ap. 25. The buds of apple trees and wild cherry trees did not open till a week later, and the caterpillars spun small nests and did no feeding. As the weather warmed, it was seen that a large number of the egg belts had hatched. The orioles and the waxwings do more than any other birds to destroy these pests at this time. May 11. The cold weather did not kill the caterpillars in this locality, and they are at work as usual. May 19. Appletree tent-caterpillars have been dying in large numbers during the past week from a bacterial disease. Forest tent-caterpillars [*Clisiocampa disstria*] are much more abundant than last year, but they do not appear to have done much damage. [*Euvanesa antiopa*] the spiny elm caterpillar, is much scarcer than last year. June 9. The young of lightning leaf-hoppers [*Ormenis pruinosa*] were observed in considerable numbers, uniting in a general gymnastic performance, the air being filled with them as they jumped up and down. They appear to do no particular harm. The tussock moth [*Notolophus leucostigma*] is present in such small numbers as to cause no appreciable damage. The sugar maple-borer [*Plagionotus speciosus*] is very common and probably causes considerable injury.

July 10. The green pea louse [*?Nectarophora pisi* Kalt.] has nearly destroyed some pieces. July 13. The pigeon Tremex, *Tremex columba*, has been quite plentiful the past two weeks. Many were found dead on the trunks of trees where they went to lay their eggs. [The presence of this insect in numbers is good evidence that the trees of Binghamton are in bad condition, most likely from the work of the maple-borer, *Plagionotus speciosus*] Aug. 9. The yellow necked appletree worm [*Datana ministra*] and the red-humped appletree worm [*Schizura concinna*] were found injuring one tree. A number of caterpillars of [*Datana integerrima*] were found on a black walnut tree. Sep. 1.

Cayuga county (Joseph Foord & Sons, Auburn)—We can not see that the recent cold weather has had any effect on the tent-caterpillars [*Clisiocampa americana*], they appear as healthy as before the freeze. May 14.

Chemung county (M. H. Beckwith, Elmira)—I have just examined several nests of tent-caterpillars [*Clisiocampa americana*], and find them alive and active where the sun is shining on the nest. A few cabbage butterflies [*Pieris rapae*] have appeared, and click beetles are numerous. May 11. Larvae of the currant worm [*Pteronous ribesii*] appeared on gooseberries May 14. May 19. Tent-caterpillars are very numerous in this section. Potato beetles [*Doryphora lineata*] have just made their appearance in quite large numbers. Asparagus beetles [*Crioceris asparagi*] are very abundant. June 1. Cut worms have been very numerous and have destroyed many plants in tobacco fields. Potato beetles are few in numbers compared with other seasons. June 2. The imported elm leaf beetle [*Galerucella luteola*] has been in this locality for several years, working mostly on the elms near the Chemung river. Its depredations do not appear to be as great this season as in former years, when at times it was so abundant that the sidewalks and fences along the streets were literally covered with the larvae. July 28.

Clinton county (A. G. Meiklejohn, Plattsburg)—Young forest and appletree tent-caterpillars [*Clisiocampa disstria*, *C. americana*] were seen on the 21st here and there from Whitehall to Plattsburg. A few cold days have caused them to disappear. Ap. 27. Young caterpillars $\frac{1}{8}$ to $\frac{1}{4}$ of an inch long were frozen stiff on the night of the 10th, but, when brought into a warm room, were soon as lively as ever. May 11. Tent-caterpillars of both species are more than usually numerous at

Putnam Station [Washington county]. May 19. The larger forest tent-caterpillars are about one third grown [at Putnam Station], and it looks as if they would be very numerous this season.

Delaware county (F. M. Simpson, Delhi)—A trip through several groves shows that very few forest tent-caterpillars [*Clisiocampa disstria*] are present, the cold of the past few days possibly having some effect. May 15. An examination of five maple groves leads me to believe that the caterpillars are the worse for the cold weather, as there were many dead ones among the leaves. Branches with the remains of the web on the surface or in the axil had no caterpillars or else dead ones. Unfortunately some of the eggs had not hatched before the cold weather, and they threaten considerable damage, specially in valleys where the sun does not strike and vegetation and other life is more backward. Others in this vicinity think that the cold has checked and possibly destroyed a large proportion of the caterpillars. Groves that were entirely denuded last year are putting forth leaves this spring on about one half of the branches. Many of the twigs are dead, and adventitious buds are springing from the sides of the branches. Many individual trees are entirely dead. May 18.

Dutchess county (H. D. Lewis, Annandale)—The warm weather of 10 days ago has brought out quite a number of tent-caterpillars [*Clisiocampa americana*]. They are less apparent now, possibly because of the cold weather. Bud moths [*Tmetocera ocellana*] are present in some numbers, but they have not caused much damage. Many young trees in this section are badly infested with the scurfy bark louse [*Chionaspis furfura*]. May 2. The recent cold weather has greatly reduced the number of tent-caterpillars. Many of the nests are smaller than usual and contain numbers of dead caterpillars. There was an enormous supply to begin with and there still remain a goodly number. This insect was probably four times as numerous as last year, and the cold weather may have reduced its numbers by one half. There is a large increase in the numbers of the forest tent-caterpillars [*Clisiocampa disstria*] which are just appearing. There is a total absence of aphids up to date. May 12. The estimated reduction of one half in the number of tent-caterpillars now appears too high, still many were killed. They are more abundant than they have been for 20 years, with one exception. May 21. The past three weeks have been pretty fully occupied fighting caterpillars, but that is nearly at an end now. Currant worms [*Pteronuss ribesii*] are present in about average numbers. Cut worms have been

very numerous since the late rains. May 26. Currant aphids [*Myzus ribis*] have appeared in large numbers and are doing more damage than the currant worm. Roses are affected with aphids. Cherrytrees and appletrees are freer from these pests than I have known them to be for years. Green fruit worms [*Xylina* species] are doing considerable damage to apples and plums. The curculios [*Conotrachelus nenuphar*] are attacking the latter to some extent. May 31. There has been a very large crop of striped cucumber beetles [*Diabrotica vittata*], squash, cucumber and melon vines requiring constant attention to save the young plants. I had one patch of Hubbard squash free one day and completely ruined the next. The curculios have been very bad on plums. Appletree tent-caterpillars have spun their cocoons, but the forest tent-caterpillar is still doing considerable damage to mapletrees and appletrees. June 19. The dry weather has caused a great increase in the number of potato bugs [*Doryphora 10-lineata*] and they are now more numerous than for some years past. Elm leaf beetles [*Galerucella luteola*], which were very destructive here four years ago, appear to be on the decrease, and so far this season they have been very scarce. June 21. The fall web worm [*Hypnatria cunea*] has appeared unusually early and in quite large numbers. It looks as if it might prove a serious pest. Squash vine-borers [*Melittia satyriniformis*] are doing a great deal of damage. June 28. Four years ago the elm leaf beetle completely defoliated our elms, in 1898 they were less abundant, less so in 1899, and there has been but little injury this season. July 20.

(F. A. Taber, Poughkeepsie)—Tent-caterpillars [*Clisiocampa americana*] are very numerous and are just hatching out. Egg clusters are more numerous than I have seen them for many years. The grapevine flea beetle [*Haltica chalybea*] has not appeared this season, and the buds are now too far advanced to suffer much injury. May 4. The cold and rain seem to have had no effect on the tent-caterpillars. They appear to be as lively as ever, and were at work this morning, though the thermometer stood at 34°. May 11. Potato beetles [*Doryphora 10-lineata*] are unusually thick and destructive. Currant worms [*Pteronous ribesii*] are not as plenty as usual. June 27. The city of Poughkeepsie has been severely scourged by the elm leaf beetle for the past few years, but this season there are very few of the pests. July 27.

Erie county (M. F. Adams, Buffalo)—[The fall army worm, *Laphygma frugiperda*] is very destructive to lawns in certain

parts of the city. I find that large patches of grass in many of the lawns were entirely destroyed and one covering a large area was entirely ruined except the front portion. The grass had been entirely eaten away and the roots killed, hardly a spear of grass remained, nothing but chickweed and other weeds growing. Most of the caterpillars were found resting on the ground, where they apparently feed, cutting off the grass below the crown and thus killing it. They select blue grass largely, which constitutes the major proportion of the lawns in Buffalo. The pupae were found in an upright position just beneath the surface. The insect apparently hibernates in all stages of development. Many of the pupae were parasitized or were otherwise diseased. Oct. 18, 1899, lime applied in large enough quantities to kill the grass had little or no effect on the insect. March 31 I took about 50 specimens of *Desmocerus palliatus* boring in *Sambucus* planted for a hedge. Many of the plants were destroyed, four and five larvae being taken from the base of a single one. The mines were so close together in some instances that all the wood was destroyed, and the bush would break off at the base while it was being trimmed. A young sugar maple which had died in the summer of 1899 was found this spring to be completely mined by a flat-headed borer, probably *Dicerca divaricata*. The mines were old and deserted. The tree came out in full leaf in the spring of 1899 but soon withered and died. Ap. 17. I have watched the tussock moth [*Notolophus leucostigma*] very closely since 1895 and have discovered but one brood in a season. The recently hatched young were observed on an egg mass early in October in 1896, but that night they were killed by a heavy frost. Ap. 19. I read an article in the morning papers that the tent-caterpillars had all been killed at Hamburg by the cold weather; so I selected that locality for making observations. Appletree tent-caterpillars [*Clisiocampa americana*] were in a perfectly healthy condition and none the worse for the cold weather. No forest tent-caterpillars [*Clisiocampa disstria*] could be found. May 15. May 17 I collected the larvae of what is probably *Cyllene picta* boring in young hickory. May 21 the adults and pupae of *Magdalis armicollis* were taken in their mines in white elm. The scholars attending one school gathered 75,000 egg masses (over 7 bushels) of the white marked tussock moth last week. May 23. The larvae of *Magdalis* have nearly all transformed to pupae. The elm-borer, *Saperda tridentata*, occurs in the pupa state at this time. May 26. *Magdalis armicollis* and *M. barbata* emerged in great numbers from elm branches May 23 and 24. A few larvae were found at this time within

the branches, but most of them were in the pupa stage. May 23 and 25 a great number of larvae of *Cryptorhynchus lapathi* were taken from American willow and Carolina poplar. The smallest measured less than a millimeter in length and ranged from that to five times as long when extended. Most of the larvae were just beneath the outer bark, some had entered the inner bark and a few were in the wood. The mines were from $\frac{1}{2}$ to 1 inch in length, irregular and winding. In many instances 50 or more larvae were removed from young trees 4 to 5 inches in diameter at the base. These trees were looked over by me two or three weeks ago, and no indications of the presence of borers were found; therefore the eggs probably hatched this spring. May 27 *Agrilus anxius* had all entered the pupal stage, most of them being pure white and but few had commenced to color. On May 5 the larvae were all straightened out and shortened but none had entered the pupal stage. May 28 the white marked tussock moth eggs commenced to hatch. On this latter date *Saperda tridentata* beetles were emerging in great numbers from white elms, being somewhat later than last year. May 30. *Saperda tridentata*, *Magdalis armicollis* and *M. barbata* have been emerging in great numbers from elm branches placed in boxes. May 31 larvae and pupae of *Saperda tridentata* were taken from elms. June 1 *Desmocerus palliatus* was observed mating and feeding on *Sambucus* hedge. June 3 none of the beetles of *Agrilus anxius* had emerged, and the pupae were hardly more colored than on May 27. June 6. The birch aphid [*Callipterus betulaecolens*] has made its appearance in great numbers. *Magdalis armicollis* and *Saperda tridentata* have emerged in small numbers. Beetles and larvae of *Crioceris asparagi* and *C. 12-punctata* were abundant June 9. Two days later great numbers of English sparrows were observed on the shoots and in places where they had been, few larvae or beetles remained; apparently they had been eaten by the birds. *Desmocerus palliatus* is still emerging in small numbers. June 15. From about 100 cocoons of the apple-tree tent-caterpillar [*Clisiocampa americana*] collected at Hamburg (N. Y.) I reared only 20 healthy adults. The rest were parasitized by *Pimpla conquisitor*, *P. inquisitor*, another species of Ichneumon fly and a Tachinid. Fall web worm eggs [*Hyphantria cunea*] commenced to hatch July 3 and some of the worms were spinning their webs. Two days later adults of *Cryptorhynchus lapathi* were found on willow. Adults of *Tremex columba* were observed

ovipositing July 11. The caterpillars of the white marked tussock moth are spinning up in great numbers. July 12.

(J. U. Metz, East Amherst)—Both species of asparagus beetles [*Crioceris asparagi*, *C. 12-punctata*] are present in some numbers this season. Currant worms [*Pteronous ribesii*] were observed for the first time this morning. May 27. Hessian fly [*Cecidomyia destructor*] is in this section in great numbers, and the wheat is nearly all down. [Palmer worms, *Ypsolophus pometellus*] are working on apples in this vicinity, biting holes in the sides of the fruit and defoliating trees in a manner similar to cankerworms. July 3. This immediate vicinity is free from tent-caterpillars [*Clisiocampa americana*] to a great extent, but there is considerable talk of damage in different parts of Erie and Niagara counties. July 21.

Fulton county (C. E. Childs, Mayfield)—Apparently appletree tent-caterpillars [*Clisiocampa americana*] will not be as abundant as last year, judging from present indications. The caterpillars are now from $\frac{1}{4}$ to $\frac{1}{2}$ inch long, and English sparrows were observed tearing open a nest. Ap. 21. Tent-caterpillars have not shown up in orchards to any extent as yet, owing to cold weather. No forest tent-caterpillars [*Clisiocampa disstria*] have been observed. May 11. The freezing weather has not killed all the tent-caterpillars; some are hatching and others may be found in the forks of limbs. English sparrows appear to be eating them in large numbers, possibly driven to it by lack of other food. I saw one family of sparrows tear a nest all to pieces and devour the inmates, which were about $\frac{1}{4}$ of an inch long. May 15. Appletree tent-caterpillars are now present in large numbers, but no forest tent-caterpillars have been seen. May 19. Appletree tent-caterpillars are not present in nearly so great numbers as last year, and now a few forest tent-caterpillars may be found. May 25. Appletree tent-caterpillars are developing fast with the favorable warm weather and their nests are becoming more conspicuous. There are very few of the other species. June 1. Tent-caterpillars were very few June 8. Hundreds of grasshoppers about $\frac{1}{4}$ of an inch long were observed in a cross-country walk. June 14. Potato beetles [*Doryphora 10-lineata*] are doing much damage at the present time. July 20. Grasshoppers are occurring in immense swarms. July 26. Sparrows are catching and killing grasshoppers, something we have never seen before, and it is probably caused by scarcity of other food. Some wrens were observed eating lice on appletrees. Aug. 3. Grass-

hoppers are more numerous than they have been for years. They move in swarms and soon eat up a piece of corn or oats. Aug. 18. Morning-glory leaves are badly mined by [*Bedellia somnulentella* Zell.] [This insect was also observed to be present in large numbers at Floral Park about the same time.] Oct. 2.

Genesee county (J. F. Rose, South Byron)—Appletree tent-caterpillars [*Clisiocampa americana*] appeared in unusual numbers last week. The season is backward, and no leaves show on the apple-trees and the buds are but little swollen. The caterpillars are feeding on the blossom buds of those varieties which are considerably advanced. The lines of silk lead from the nests to the fruit spurs. The nests are very numerous on the wild cherry, and on these no leaves have appeared. May 1. I am unable either by observation or by inquiry of prominent fruit growers to learn that the cold did any injury to the young caterpillars. Ice $\frac{1}{4}$ of an inch thick formed here, and there were hard frosts for several nights. May 11. Tent-caterpillars are very bad in many orchards. Spraying is neglected by many till the caterpillars have attained considerable size, and then they have poor success in killing them with paris green. When the poison has been used at the rate of 1 pound to 100 gallons or stronger, the results have been better. Many of the caterpillars are now full-grown and have begun to travel, preparatory to spinning their cocoons. Cankerworms have been working so badly in some orchards that spraying while the trees were in full bloom has been done. Eye-spotted bud moths [*Tmetocera ocellana*] have greatly increased, and many are found on pears and quinces. Potato beetles [*Doryphora rolineata*] were found in numbers today, though they had been scarce previously. May 26. The early potato and tomato leaves look like sieves, as the result of the work of the cucumber flea beetle [*Crepidodera cucumeris*] The striped cucumber beetle [*Diabrotica vittata*] is present in usual numbers. Tent-caterpillars are far more numerous than ever before and are now crawling everywhere. The forest tent-caterpillar [*Clisiocampa disstria*] is not as bad as last year. The pear psylla [*Psylla pyricola*] has been very troublesome and difficult to control. June 12. I was called to see an orchard which is in a very serious condition from the attacks of an insect [palmer worm. *Ypsolophus pometellus*]. June 14. The crop in this orchard of 300 trees is a complete failure, though there was a full bloom. It was sprayed with paris green only, the first time when the fruit was as big as peas and then last week. Tent-caterpillars were also rather

abundant in the orchard, but the palmer worm caused the principal damage. I find palmer worms in greater or less numbers in very nearly every orchard but one. A large proportion of the leaves are nearly skeletonized and much of the fruit spoiled by holes eaten in the side. June 20. Potato beetles have done little damage up to the present time. The squash bug [*Anasa tristis*] is very numerous, and squash, pumpkins and cucumbers require constant protection. The sugar maple-borer [*Plagionotus speciosus*] is attracting more and more attention as dead trees become abundant. Some "sugar bushes" are almost ruined. Aug. 15.

Greene county (O. Q. Flint, Athens)—There is no question that the harm to the sugar maple trees is great and extended as a result of the work of the forest tent-caterpillar [*Clisiocampa distria*] in this vicinity. The output of sugar will be the lowest in years, this being due in great measure to the work of this pest. Many maples in this county and also in Otsego have been cut down, and it is found that they are more or less dead, the portion of the tree facing the southeast appearing to have suffered most. Ap. 17. Consultation with a number of persons in the towns of Jewett, Lexington and Halcott show that there is quite a difference of opinion as to the forest tent-caterpillars hatching out this spring. Some think they will be more numerous, and others think that they will be less abundant. May 9. A drive through the towns of Athens, Catskill, Cairo, Hunter, Jewett and Windham shows that the appletree tent-caterpillar [*Clisiocampa americana*] is quite prevalent, and that while the forest tent-caterpillar is present, it does not occur in such numbers as last year. The cold weather has had no harmful effect on them. May 21. A trip through the eastern and the southwestern part of Greene county, the northern part of Ulster county and the northeastern part of Delaware county shows that the forest tent-caterpillar bids fair to do as much or more injury than last year. Its appearance is from 10 days to two weeks earlier in the eastern part of Greene county than in the western portion. Reports of depredations in orchards have already come to hand. The wood from the defoliated sugar maples is quite generally believed in this vicinity to have an inferior value as fuel. The elm leaf beetle [*Galerucella luteola*] is much in evidence in Athens. The recent cold weather does not appear to have injured either the forest tent-caterpillar or the elm leaf beetle. May 29. The former insect is doing extensive damage in the western, central and east central parts of this county. June 11. Forest tent-caterpillars have not been so abundant in places where they

occurred the preceding two years, but they have invaded new territory, and it is doubtful whether their numbers have been reduced. June 21. [Birch twigs with the petioles occupied by a small curculionid larva were received with the following statement from Mr Flint.] The effects are very noticeable in the vicinity of Pinehill, Ulster co. and adjacent territory. The leaves are mostly wilted and some of them have turned brown. June 30. Cherry aphid [*Myzus cerasi*] is numerous in some parts of Athens. July 3. The elm leaf beetle is doing considerable damage in the river section of this county, but it is not so serious as last year. It does not appear to be present any great distance from the river. Aug. 3. A second brood of elm leaf beetles is now developing. The injury to maples in certain parts of this county is irremediable, as in the towns of Jewett, Lexington, and also in Worcester and Decatur, Otsego co. The fall web worm [*Hyphantria cunea*] is present in rather small numbers. Aug. 26.

Herkimer county (G. S. Graves, Newport)—More than 90% of the egg belts of the forest tent-caterpillar [*Clisiocampa disstria*] are on the maple trees. Many of the egg belts are quite irregular in form. Oct. 16. There do not appear to be more than 25% as many egg belts as there were last fall. Ap. 5. Brown and black woolly bears [*Pyrharctia isabella*] are very abundant, even crawling on the snow. The pupils in school 21 of Utica collected 11,729 egg clusters of the forest tent-caterpillar this spring. Ap. 17. Appletree tent-caterpillars [*Clisiocampa americana*] were first noticed last Sunday, the 22d, and since that time they have appeared in considerable numbers, particularly on appletrees. Forest tent-caterpillar eggs are practically free from the protective covering. Ap. 28. Both species of tent-caterpillars are hatching rapidly and in numbers, the forest tent-caterpillars appearing four days later than the others. May 4. All the forest tent-caterpillars seen by me on the 5th and 7th seemed to be alive, and on the latter date they were warmed up enough to drop readily on threads when the limbs were jarred. The recent cold does not appear to have affected them. May 10. I examined today 500 to 1000 clusters of caterpillars of both species and feel justified in saying that they were not harmed by the cold weather. I saw in several instances the cast skins of caterpillars, and at first could not locate their present whereabouts, but in each case they were finally found. No caterpillars have as yet been seen on the maples, which are leafing out very slowly. May 14. Case-bearers [probably the cigar case-bearer, *Coleophora fletcherella*] are quite numerous on the apple. May 19.

The case-bearer appears to be present on many trees. The maples are affected by some insect, a borer [probably the maple borer, *Plagionotus speciosus*] May 25. Forest tent-caterpillars are quite plentiful on the witch hazel and occasionally on the hickory. They are appearing a little more abundantly on maples, but in many instances they are more numerous on the appletrees. May 29. Appletree bark louse [*Mytilaspis pomorum*] appears to be increasing on the appletrees in this vicinity. June 5. This year the forest tent-caterpillars appear to have deserted the maples for apple and basswood. Currant worms [*Pteroninus ribesii*] are just beginning to damage the bushes. June 11. At least 75% of the cocoons of the forest tent-caterpillars on some appletrees are parasitized. June 30. In adjacent forests at least 90% of the cocoons of the forest tent-caterpillars have been destroyed by parasites. July 6. *Datana ministra* appears to be very destructive to apple and elm, and the cigar case-bearer has been quite injurious in this section. Aug. 7. Cabbage butterflies [*Pieris rapae*] have become very numerous since my last report. Aug. 24. Woolly apple aphid [*Schizoneura lanigera*] is quite plentiful, specially on sprouts growing from roots. Oct. 15.

Jefferson county (George Staplin, Mannsville) — Appletree tent-caterpillars [*Clisiocampa americana*] are not as numerous as last year. The horn fly [*Haematobia serrata*] has appeared on cattle. May 19. No forest tent-caterpillars [*Clisiocampa distria*] have been seen. Cut worms are attacking corn to some extent. Curculios [*Conotrachelus nenuphar*] are working on plums and to some extent on pears. Many dead grasshoppers are found in the meadows. [They were subsequently found to be infested by *Masospora cicadina* Peck, as determined by state botanist Peck.] June 6. The first forest tent-caterpillar was observed June 9, and I have seen less than 20 this year. Spittle insects are plenty in meadows. June 12. Cigar case-bearer [*Coleophora fletcherella*] is working to some extent on pear leaves. June 16. A forest tent-caterpillar was seen Aug. 1, probably the last of the season. They have done no appreciable damage in this section. Potato beetles are not nearly as numerous as in preceding years. Yellow-necked apple worms [*Datana ministra*] are just hatching but are not very numerous yet. Katydidids are very abundant. Aug. 15. Fall web worms [*Hyphantria cunea*] are plenty on maple and ash but are not abundant on appletrees. Sep. 15.

Livingston county (W. R. Houston, Geneseo) — Tent-caterpillars [*Clisiocampa americana*] made their appearance on fruit trees

in this locality about Ap. 12, and they are just as numerous as last year, if not more so. May 12. I have noticed on the fruit trees many dead caterpillars, which, I think, is due to the cold weather of April and the first days of May. A few asparagus beetles [*Crioceris asparagi*] were observed today for the first time this season. May 19. About a week ago I noticed on a young peachtree that some kind of a bud worm was attacking the unfolding leaf buds [probably *Anarsia lineatella*]. Many of the young apple and peartrees are covered with green plant lice. May 25.

Madison county (C. A. Owen, Munnsville)—The frosts have injured the apple and forest tent-caterpillars [*Clisiocampa americana*, *C. disstria*] some, but I am unable to ascertain how much. In some localities they have been hurt more than in others. Appletree caterpillar tents are being quite generally destroyed in this section. May 17. A farmer told me yesterday that last year the forest tent-caterpillars stripped a piece of wheat that grew near the woods. May 24. They are very abundant on the hills, but in the valley they are not one hundredth part as thick as last year. The late spring frosts seemed to be heavier in the valley, and numerous places can be seen where the caterpillars hatched and began to move and then were killed by the cold. June 1. There is not much change to report. In one place the forest tent-caterpillars have left a piece of woods in a body, going across the road in an almost solid mass toward a stone wall, though no trees were within three quarters of a mile. Another man says that the caterpillars have left the woods and attacked a nearby red raspberry patch. June 8. The tent-caterpillars of both species are nearly all gone. They have worked in strips here and there. Some of the caterpillars dropped out of their leaves after they were unable to crawl, and perished. June 21.

Monroe county (Lewis Hooker, Rochester)—Appletree tent-caterpillar [*Clisiocampa americana*] eggs have hatched within the past week, and the larvae are building their tents, apparently as numerous as in previous seasons. The plum Lecanium is also developing very rapidly, and on our trees it is very numerous. May 5. The pistol and cigar-case bearers [*Coleophora malivorella* and *C. fletcherella*] have commenced their depredations on the appletrees. The bud moth [*Tmetocera ocellana*] has also commenced feeding on the buds. May 11. The cold, rainy weather has not affected the tent-caterpillars. May 12. Nymphs of pear psylla [*Psylla pyricola*] have appeared. Case-bearers and bud moths are doing considerable damage to apple-

trees. May 17. Cankerworms have made their appearance on the appletrees in this vicinity. The gooseberry and currant bushes begin to show the work of the currant worm [*Pteronus ribesii*]. May 24.

Montgomery county (Dr S. H. French, Amsterdam)—The forest tent-caterpillar [*Clisiocampa disstria*] caused some damage here last year; and we shall probably suffer much more the present season. Ap. 12. May 6 I found nests of appletree tent-caterpillars [*Clisiocampa americana*] on choke cherry bushes outside the city. The nests were about 2 inches in diameter, and the caterpillars were very sluggish but were active when warmed up. May 9. Appletree tent-caterpillars appear to be less in number than for several years past. No effort is being made to destroy the forest tent-caterpillars. May 22. There have been practically no forest tent-caterpillars in this city. June 11.

Niagara county (R. H. Darrison, Lockport)—Farmers think that the recent cold has simply retarded the development of the caterpillars, and they think that there will be an unusually large number of appletree tent-caterpillars [*Clisiocampa americana*]. May 11. Tent-caterpillars are growing rapidly and are present in great numbers south of the city. May 20 one nest was found with 230 two thirds grown caterpillars. May 24. The caterpillar pest has been pretty well controlled in this vicinity by spraying and destroying the nests. June 2. Cankerworms are doing considerable mischief to appletrees in many places in this part of the state where the trees have not been protected. June 9. The two asparagus beetles, *Crioceris asparagi* and *C. 12-punctata*, are present in this vicinity. A pest is feeding on the green fruit, eating into the young apples from the outside [in all probability the palmer worm, *Ypsolophus pometellus*]. July 26.

Oneida county (Mrs M. S. Miller, Aldercreek)—The roadsides are much whitened by caterpillar tents, the nests being not only on trees and shrubs but also on milkweed, grasses and any green thing. [This is the cherry Tortrix, *Cacoecia cerasivorana*]. Potato beetles [*Doryphora 10-lineata*] were never worse. June 21. The woolly elm aphid [*Schizoneura americana*] is disfiguring the leaves of a young elm. The cherry Tortrix continues to be abundant along the roadsides. June 27. Potato beetles are not numerous and grasshoppers are few. July 16. The monarch butterfly [*Anosia plexippus*] is present in very great numbers. Aug. 15.

Onondaga county (Mrs A. M. A. Jackson, Warner)—I can not see that the cold weather has had much effect on the appletree tent-cater-

pillars [*Clisiocampa americana*] in this section. They remained in the web during the cold spell. They appear to have been a little late in hatching, as no webs were observed till after May 1, while along the highway in the valley webs were numerous Ap. 26. Lady beetles were found in the vicinity of egg clusters which had been eaten out by some insect. A large spined soldier bug [*Podisus spinosus*] was seen with a small tent-caterpillar on its extended beak. May 11. Cankerworms made their appearance about May 10, and on the 28th, as we drove from Warner to Syracuse, I did not see a tree but that was badly eaten by them. They were on elm, maple, basswood, apple, cherry, etc. They are by far the worst pest in this section. There do not appear to be as many appletree tent-caterpillars as usual. A few forest tent-caterpillars [*Clisiocampa disstria*] have been seen, but they are not doing much damage. June 6. Wheat was damaged more than last season by the Hessian fly [*Cecidomyia destructor*], as fully one third was down. The damage was confined to a few fields of early sown grain. July 24.

Ontario county (J. J. Barden, Stanley)—The orchards about Union Springs, Cayuga co., are badly infested with [*Lecanium ? cerasifex*]. Dec. 14. The freezing of the past week does not seem to have decreased the numbers of tent-caterpillars [*Clisiocampa americana*]. I have found thousands of nests, and in none of them were there dead caterpillars. The forest tent-caterpillar [*Clisiocampa disstria*] appears to be ten times as abundant as last year. They seem to be unaffected by the cold. The fruit tree bark beetle [*Scolytus rugulosus*] is doing great damage in commercial orchards near Geneva. May 14. The pale striped flea beetle [*Systema taeniata*] is working serious mischief on seedling appletrees, and it is also very abundant on sugar beets. The 12 spotted asparagus beetle [*Crioceris 12-punctata*] has appeared at Stanley and also at Newark. July 2. Colorado potato beetle [*Doryphora 10-lineata*] has done little damage the present season. The 12 spotted asparagus beetle is very abundant at Fredonia, Chautauqua co. and at Almond, Allegany co. The common asparagus beetle is also abundant at these places. Aug. 16.

Orange county (J. M. Dolph, Port Jervis)—The scurfy bark louse [*Chionaspis furfura*] is bad on currant bushes in some places. Ap. 23. The tent-caterpillar [*Clisiocampa americana*] has never been very abundant in this region, and I have seen but one nest

this season. Many of our maples are affected by borers [probably *Plagionotus speciosus*]. May 14. I inclose a piece of bark from a Siberian willow which was killed by a scale insect [appletree bark louse, *Mytilaspis pomorum*]. Aug. 8.

Orleans county (Virgil Bogue, Albion)—I am unable to find any evidence of the cold seriously affecting the tent-caterpillars [*Clisiocampa americana*]. They are not abundant in this vicinity. May 12. The foliage of fruit trees in this section is the most perfect I have known it to be for years. The palmer worm [*Ypsolophus pometellus*] is not present here. July 17. I recently took the inclosed specimen [*Polystochoetes punctatus*]. I have never seen one like it. Honeybees have done better than last year, but even this is not very good. Aug. 20.

Oswego county (C. B. Cook, Oswego Center)—Appletree tent-caterpillars [*Clisiocampa americana*] are numerous in this section, but forest tent-caterpillars [*Clisiocampa disstria*] are comparatively scarce. The cold weather does not appear to have harmed the tent-caterpillars. Bud moth [*Tmetocera ocellana*] has commenced work to a considerable extent in some orchards. A borer is operating in tomato stalks under glass. [It may be the stalk-borer, *Hydroecia nitela*.] May 17. Cabbage worms [*Pieris rapae*] and potato beetles [*Doryphora 10-lineata*] are appearing in considerable numbers. Appletree tent-caterpillars are very numerous, but there are very few of the forest tent-caterpillars. May 30. Appletree tent-caterpillar is very bad in many orchards, the worst I have ever seen. Asparagus beetles [*Crioceris*] are destructive in this section. The common currant worm [*Pteronus ribesii*] is doing some damage. June 12. During the past week white grubs have been doing considerable harm in recently set strawberry beds. There have also been a few bad cases of cankerworms on appletrees. The appletree tent-caterpillar has done more damage than was anticipated, denuding many orchards. The plum curculio [*Conotrachelus nenuphar*] is quite numerous on my place. The insect, which eats holes in the sides of apples and pears, has injured considerable fruit, but, owing to the exceptionally full set, the damage will not be very great. [This may be *Xylina antennata* or *Ypsolophus pometellus*.] Potato beetles have been abundant this spring. June 29. The first brood of codling-moth [*Carpocapsa pomonella*] is doing much damage to apples and less to pears. Potato beetles [*Doryphora 10-lineata*], striped

cucumber beetles [*Diabrotica vittata*] and squash bugs [*Anasa tristis*] are present in usual numbers. Tomato worms [*Phlegethontius celens*] are doing some damage. Curculio injury has been comparatively light. The cabbage worms are unusually persistent. Aug. 8.

Otsego county (L. I. Holdredge, Oneonta)—The spring brood of *Pieris rapae* is quite abundant. The larvae of *Clisiocampa disstria* have already appeared on the maples in several instances. This insect has been a great pest in this locality for the past two years, specially the last, when the caterpillars stripped many of the maples, as well as greatly damaging sugar bushes in the vicinity. I have collected Lepidoptera for about 10 years in and about Oneonta, and previous to 1897 *Clisiocampa disstria* was very rare, so that up to that time it was represented in my collection by but five native examples. During this time *Clisiocampa americana* was very common. Now it is difficult to find an example of the latter. The maple and apple trees are literally loaded with eggs of the forest tent-caterpillar. Ap. 30 The recent rains and prolonged cold weather have materially lessened the danger of injury by the forest tent-caterpillar. The bad weather came just as the larvae were hatching and killed very many. I find, however, that there are still a goodly number of caterpillars on the maples, but I have noticed scarcely any on the apple trees. May 21. The caterpillars of *Euvanessa antiopa* have been particularly destructive to elms and in some cases they have stripped the leaves from the upper branches. Oneonta has not been damaged by the forest tent-caterpillar, though reports are received of their work from nearby places. July 16.

Queens county (C. L. Allen, Floral Park)—Asparagus beetles [*Crioceris asparagi*] were never worse. May 11. The pea aphid [*Nectarophora pisi* Kalt.] so destructive last year, has visited but one farm this season, and the injury there is but slight. The potato beetle [*Doryphora 10-lineata*] is very much in evidence. May 24. The pea aphid is doing considerable damage. The early crop has not suffered much, but there is little hope for later plantings. The pines at the east end of the island are being destroyed by a weevil. [It proves to be the work of several species of bark beetles] June 19. Hundreds of acres of peas are now being plowed under, a result of the work of the pea aphid. June 29. The [margined blister beetle, *Epicauta cinerea*] is doing considerable mischief in my beets. July 10.

Rensselaer county (W. C. Hitchcock, Cropseyville)—I have been unable to find that a single colony of the tent-caterpillars [*Clisiocampa americana*] was destroyed by the frost of some 10 days ago, though I found a number of caterpillars which had been killed. I have never known the appletree tent-caterpillars to be more plenty than at present. I have observed the orioles, vireos, chickadees, and wood sparrows feeding on them. May 21. The stalk-borer, *Hydroecia nitela*, is doing a great deal of damage in some cornfields. One appletree has been nearly destroyed by plant lice, *Aphis mali*, which cause the leaves to curl so badly. June 16. Grasshoppers have become a serious pest in this immediate vicinity. Farmers are in many instances cutting their oats in order to save them, and one declares that more oats lie on the ground than remain on the stalk. In two cases buckwheat has been entirely destroyed. Aug. 1. I find that the grasshoppers are most numerous in a belt reaching from Castleton through the towns of Schodack, Sandlake, Poestenkill, Brunswick and Pittstown, more numerous in some places than in others, but causing much damage all the way. The horn fly [*Haematobia serrata*] has never been so numerous as now. Aug. 13. [The principal species of grasshoppers concerned in the above recorded depredations prove from examples sent to be the red-legged grasshopper, *Melanoplus femur-rubrum* DeGeer, and the large Carolina locust, *Dissosteira carolina* Linn.]

Rockland county (S. B. Husted, Blauvelt)—Tent-caterpillars [*Clisiocampa americana*] have appeared as usual but not in large numbers. The cool weather has undoubtedly retarded them. May 9. May beetles are unusually prevalent this season, and, by an experiment with a lighted lantern in a tub partly filled with water on the piazza over night, we caught about 50. They have been quite destructive to the young shoots of plum, seeming to prefer the choice buds of Climax plum. The pear midge [*Diplosis pyrivora*] has appeared in numbers. But two potato beetles [*Doryphora 10-lineata*] have been seen so far. There are but few elm leaf beetles as yet. May 26. The elm leaf beetle [*Galerucella luteola*] was very destructive some years ago, but now it is present in very small numbers. The oaktree-pruner [*Elaphidion villosum*] is more injurious than usual, strewing the lawn with branches cut from the trees. July 20.

St Lawrence county (Mary B. Sherman, Ogdensburg)—Spring cankerworm moths, *Paleacrita vernata*, were unusually numerous

in one garden. [*Raphidodemas titea* Cram.] was also taken at this time. Ap. 26. Appletree tent-caterpillars [*Clisiocampa americana*] made their appearance during a warm spell on Ap. 28. It has been very cold since, the mercury dropping to 15° and 20° above zero, and I have not seen any of them since then. May 10. I find on a neighbor's trees many tent-caterpillars which have survived the recent cold and rain. The town is full of birds, and they are doing good work feeding on the forest tent-caterpillars [*Clisiocampa disstria*]. May 18. The English sparrow has been eating the forest tent-caterpillars, and last summer they attacked the cocoons and fed on the moths. We have an unusual number of orioles, which I have seen feeding on the caterpillars. I have also seen the yellow and several other warblers, the yellow-billed cuckoo, the robin, the cedar waxwing and, I believe, the house wren feeding on the caterpillars. The maples in front of the house have been filled with warblers, all of which were very busy with the trunks and branches, and yesterday I noted five varieties. May 26. We have practically no forest tent-caterpillars in town. They hatched in large numbers, but the cold evidently killed many, and the birds appear to have cared for the remainder. They are said to be present in large numbers in the country. The appletree bark louse [*Mytilaspis pomorum*] is abundant on appletrees, vines and shrubs. June 1. I have seen but one forest tent-caterpillar since sending my last report. The appletree tent-caterpillar is very abundant in the country. June 9. Two fine maples are badly infested with borers [since proved to be *Prionoxystus robiniae*]. June 16. I send you two pupal cases [*Prionoxystus robiniae*] which were projecting from the trunk of the tree. Much of the bark on this tree is loose, and the trunk is full of burrows. June 20. Moths of [*Prionoxystus robiniae*] were taken on the infested maple today, the 2d. Pupal cases of this insect are very abundant on the trees at the state hospital. Grasshoppers are present in myriads, more than we have ever seen before. The spiny elm caterpillar [*Euvanesa antiopa*] has done much damage to small elms. July 2. There are a great many beautiful maples dying in this vicinity, probably from borer attack, as mentioned above. The gouty gall beetle, *Agrilus ruficollis*, is causing considerable trouble. July 7.

Saratoga county (Rhoda Thompson, Ballston Spa)—Neglected appletrees and maples show signs of injury from the appletree tent-caterpillar [*Clisiocampa americana*] and from the forest tent-caterpillar

[*Clisiocampa disstria*]. June 2. Tent-caterpillars have appeared in considerable numbers. June 8. Apple aphid [*Aphis mali*] is very abundant on some trees, causing the leaves to curl. June 18.

Schenectady county (Paul Roach, Quaker Street)—Tent-caterpillars [*Clisiocampa americana*] are just hatching on the sunny side of the egg clusters. On the 8th they were active and feeding on the buds, and that night we had a hail storm, and on the 9th it was cold and windy, and they seemed dormant but hugged closer together. On the night of the 9th ice one half inch thick was formed, and on the morning of the 10th the caterpillars were still alive, but they seem dormant, and, if the cold spell lasts a few days, I think that many will starve to death. Eggs of the white marked tussock moth [*Notolophus leucostigma*] are quite numerous. May 10. The forest tent-caterpillar [*Clisiocampa disstria*] has worked havoc in orchards here, some being as bare as in midwinter. The appletrees suffered most, next plum, pear and cherry. Forest trees are attacked in the order named: ash, linden, elm, and maple. Some of the caterpillars died of a disease; about May 25 the rest began to spin their cocoons. At this time a cold storm came on, and but very few cocoons can be found. My orchard and shade trees were sprayed with arsenate of lead, and, while great clusters of worms can be found on the trees, the caterpillars have eaten but little, some not at all. It is cheap, easy of application, efficient, and with me has not burned the foliage of Japanese plums, the tenderest of all. June 22.

Schoharie county (J. F. Johnson, Breakabeen)—The appletree tent-caterpillar [*Clisiocampa americana*] is appearing in great numbers this spring. I have also found many forest tent-caterpillars [*Clisiocampa disstria*]. May 10. The cold and frost of last week has checked the caterpillars. May 19. The forest tent-caterpillars are doing very much damage. They are attacking the plum and other fruit trees. May 25. Appletree bark louse [*Mytilaspis pomorum*] is very thick on poplar and willow. There is now considerable variation in the size of forest tent-caterpillars; some are full-grown and others half the size. June 1. Forest tent-caterpillars are spinning their cocoons. They have done a great deal of damage this year, stripping the foliage from many trees and then attacking the new growth. July 26. The moths of [*Clisiocampa disstria*] are appearing in great numbers. In a place 5 miles square I think there are 500 acres of woods which have been defoliated by the forest tent-caterpillars. July 13. A little black

beetle [*Epitrix cucumeris*] has worked on beans and potatoes to some extent. Aug. 6.

Schuyler county (H. W. Smith, North Hector)—Appletree tent-caterpillar [*Clisiocampa americana*] has appeared on wild cherry-trees. The appletrees are quite generally infested with [the apple aphid, *Aphis mali*], the insect being very numerous on the buds. Ap. 26. The apple aphid is still present on unsprayed trees; and in several instances a small brown worm was found eating into the buds. [It is the bud moth larva, *Tmetocera ocellana*.] Tent-caterpillars are hatching on appletrees and peachtrees in great abundance. May 4. The tent-caterpillars have been killed to some extent by the cold, but those on trees in sheltered places are as lively as ever. May 12. The common asparagus beetle [*Crioceris asparagi*] was found for the first time this spring. Tent-caterpillars have begun feeding again with the return of warm weather. May 17. Currant worms [*Pteronurus ribesii*] are working to some extent on unsprayed currant bushes. May 24.

Seneca county (J. F. Hunt, Kendaia)—Tent-caterpillars [*Clisiocampa americana*] commenced hatching about Ap. 22-25, and now they are very abundant. Forest tent-caterpillars [*Clisiocampa distria*] hatched from Ap. 28 to 30, and they seem to be nearly as numerous as the other species. Last spring was the first time that I saw the forest tent-caterpillar in this section. I found today where they had eaten holes through the sides of peach buds to get at the flower within. May 3. The hard freeze of May 6 and 7 did little damage to the caterpillars, it only checked their feeding. There are plenty of curculios [*Conotrachelus nenuphar*] waiting on the plum and apricot trees for the fruit. May 15. Both species of tent-caterpillars are abundant, though there are few of the appletree species within their tents. The curculios are more abundant on the plums and apricots than for many years. I have taken as many as 50 in jarring one tree, and obtain an average of 40 from large trees. There are very few plums stung yet. Our greatest trouble is the forest tent-caterpillar, which is numerous on almost every tree. May 29. Curculios are so abundant that it would be impossible to save our plums, were there only an average setting of fruit; as it is, after three fourths have been stung, there will be plenty left. We have caught over 5000 from less than 200 trees, and we never had anything like it before. Reports from all over the county confirm the statement that the forest tent-caterpillar is abundant in places where but few were seen last year. June 6. The cherry aphid [*Myzus*

cerasi] was very abundant at one time this season, but a lady bug and its larva and other beneficial insects soon reduced it to comparatively harmless numbers. The Hessian fly [*Cecidomyia destructor*] has done considerable damage to some pieces of wheat in this section. The currant worm [*Pteronus ribesii*] was not as abundant as in previous years. July 7.

Steuben county (E. P. St John, Prattsburg)—The webs of the appletree tent-caterpillar, *Clisiocampa americana*, are very abundant on wild cherry. The first web was noticed May 2. Sometimes one tree contains a dozen webs. May 7. The recent cold weather has apparently not harmed the tent-caterpillars. The caterpillars have not been very numerous on my farm since I sprayed my trees last year just after they blossomed, with paris green and bordeaux mixture and supplemented that by burning the nests. This year I found the eggs most abundant in one corner of my orchard near some wild cherrytrees, on which the insects evidently bred. May 15.

Tompkins county (C. E. Chapman, Peruville)—Appletree tent-caterpillars [*Clisiocampa americana*] began hatching Ap. 22; only about two thirds of the eggs hatched. Green aphids [*Aphis mali*] are abundant on appletrees. May 1. The cold weather has held the tent-caterpillars in check but otherwise it does not seem to have harmed them. May 15. Potato beetles [*Doryphora 10-lineata*] are numerous on early planted potatoes. Appletree tent-caterpillars are now well grown. Plant lice are thick on young plumtrees and also on strawberry plants. June 5. The grubs of May beetles are feeding on young blackberry shoots. June 12. Forest tent-caterpillars [*Clisiocampa disstria*] are everywhere but not in sufficient numbers to cause much damage. The 12-spotted Diabrotica [*Diabrotica 12-punctata*] is attacking sugar beets in small numbers. Potato beetles are not thick and no eggs have hatched yet. June 26. Striped cucumber beetles [*Diabrotica vittata*] are abundant, and the same is now true of potato beetles. Some forests show the effects of the forest tent-caterpillars, and some bee-keepers complain of the lack of basswood blossoms, which have been cut off by the caterpillars. July 9. Hessian fly [*Cecidomyia destructor*] is bad in unharvested fields of wheat. July 26.

Ulster county (G. S. Clarke, Milton)—Appletree tent-caterpillars [*Clisiocampa americana*] are much more numerous than they were last year. They threaten to do considerable damage. The bud

moth caterpillars [*Tmetocera ocellana*] are quite abundant on appletrees. May 4. The cool weather of the past few days has kept the insects in check. May 12. The currant worms [*Pteronus ribesii*] are increasing in numbers, and many are spraying their bushes with poison. A bud moth [probably *Anarsia lineatella*] is hurting peaches in some localities. May 19. The currant worm has been abundant in places where it was not fought last year. Tent-caterpillars have about all spun their cocoons. A small caterpillar [probably *Anarsia lineatella*] has been working in the peach blossoms, and it has also cut off a great many sets. The bud drops off early as a result of the attack. May 26. A few aphids occur on appletrees and cherry-trees and currant bushes. Pear psylla [*Psylla pyricola*] is present in small numbers, but has been controlled in a neighboring orchard by spraying with a mechanical kerosene emulsion. June 1. The aphid is quite plentiful on cherrytrees, there are some on appletrees and a few on currant bushes. Second brood of currant worms is hardly apparent. June 15. The second brood of currant worms was numerous where the bushes had not been sprayed. June 30. Two years ago the elm leaf beetle [*Galerucella luteola*] denuded a number of trees, but this season the attack has been much less severe. The squash bug [*Anasa tristis*] is plenty on some vines. July 26.

Warren county (C. L. Williams, Glens Falls)—Two small beetles [*Silvanus surinamensis* and *Cathartus gemellatus*] were sent with the statement that for some time one of the large shirt and collar factories had been troubled with dirt and stains in the collar linings. The stain was like iron [and from examples submitted later for inspection, it was seen that they were probably caused by the crushed particles of these insects, though the remains were so fragmentary as to prevent any attempt at more than a probable determination]. Once I found what was certainly a fragment of a wing cover of one of these beetles, and the insects were taken from the cloth. Oct. 20. An offer of 50c a hundred for egg clusters of the forest tent-caterpillar [*Clisiocampa disstria*] resulted in the collection on the 7th of 2100 egg belts, of 4700 on the 14th and 4400 on the 18th. There were quite a number of the eggs hatching on the latter days, but the egg belts had probably been kept in a warm place by the children. Many of the appletree tent-caterpillar eggs [*Clisiocampa americana*] are brought in with the others and are also bought. Ap. 20. Saturday 3490 egg belts were bought and today 500 more. The caterpillars are hatching out rapidly, the appletree species being the first to

appear by a few days. Ap. 27. I have found many egg clusters with more than 250 eggs. May 4. Your request for information concerning the effect of the recent cold and rain upon the tent-caterpillars was received. At 5 o'clock I found a colony which at first glance appeared dead. Closer observation showed that they were only dormant, and the apparently dead ones were the cast skins of the first molt. In half an hour after bringing the caterpillars into a warm room, they began to move and now, 7.30, they are as lively as they can be. They are now $\frac{3}{8}$ of an inch long. Last night the temperature fell to 29° F., and at 6.30 this morning the surface of the ground was frozen. Still farther: I have a colony of the caterpillars which I found just hatched out 13 days ago that have been kept in the temperature of the out of doors air, *without food*, and they are still well and in good working order, though a little thin. May 11. The young caterpillars mentioned in my previous report lived 16 days without food. May 18. A trip about the village shows only here and there slight evidences of the caterpillars, which are now about $\frac{1}{2}$ inch long. May 25. The forest tent-caterpillars are quite injurious in some sections of Glens Falls, specially in parts where they had not been numerous the preceding season. The caterpillars in these places are $1\frac{1}{4}$ inches long. May 28. Forest tent-caterpillars are not abundant in the village, particularly where they were diligently fought last season. Natural enemies as well as artificial means of destruction have brought this about. There are more of the pests in South Glens Falls and Sandyhill. June 8. The forest tent-caterpillars appear to have all disappeared. Appletree tent-caterpillars have not been so few for years. Neighboring villages have had plenty of them. The rose beetle [*Macrodactylus subspinosus*] is abundant on daisies and at times does great damage to roses. One gentleman has had his grape blossoms entirely destroyed by it. June 29.

Washington county (H. L. Beadle, West Cambridge)—Apple aphid [*Aphis mali*] is very abundant. May 2. Appletree tent-caterpillars [*Clisiocampa americana*] were present in usual numbers a week ago, but this morning I found only 22 nests, and 50% of the caterpillars in those were dead. May 11. Closer examination shows that tent-caterpillars are very scarce. The cankerworm has appeared in destructive numbers in a few localities.

Wayne county (C. H. Stuart, Newark)—I fail to find that the cold did any harm to the appletree tent-caterpillars [*Clisiocampa americana*], though some of our men think such to be the case. I find them

on apple, plum, peach, cherry, wild cherry, apricot, pear, elder, dogwood and American elm. Some are about two weeks old and $\frac{1}{2}$ inch long and others are just hatching. May 11. I found 10 soldier bugs [*Podisus spinosus*] around one nest of the tent-caterpillar, one of which was feeding on a caterpillar. I have repeatedly found these bugs with the larva of a potato beetle on the extended beak. May 14. I am now convinced that the recent cold did the appletree tent-caterpillar little harm, for, though some recently discovered caterpillars were not more than $\frac{1}{8}$ inch long and had almost no web to cover them, they went through a frost that froze the leaves stiff night before last without the least appearance of injury. May 14. Many of the appletree tent-caterpillars are nearly full-grown and they are more active than ever. The damage to many orchards is something awful, as they have lately been working on a large variety of trees, though they show a decided preference for apple and cherry. In addition to the preceding list, I have also found them working on the thorn (Pauls new double), beech and poplar. May 28. The cankerworm has appeared in great numbers in both orchards and forests. Many orchards are as brown as though burned by fire. Both species of tent-caterpillars have done great damage. June 5. The inclosed beetle [*Systema taeniata*] has destroyed nearly 20,000 apple seedlings within a week. It was easily controlled by spraying with paris green. The seedlings are cultivated every week, and it was between two cultivations that the mischief was done. June 27.

Westchester county (Mrs E. H. Mairs, Irvington)—The cold weather delayed the appearance of the appletree tent-caterpillar [*Clisiocampa americana*], but did not destroy many. Potato beetles [*Doryphora 10-lineata*] are unusually numerous, cutting young plants off above the surface and devouring eggplants as soon as set out. May 25.

Wyoming county (W. H. Roeper, Wyoming)—Apple aphid [*Aphis mali*] is very abundant on the buds. The appletree tent-caterpillar [*Clisiocampa americana*] made its first appearance today. The insect will probably be very abundant. Ap. 27. The cold weather has kept the tent-caterpillars back, and they are working rather slowly, but the hard frosts do not seem to have killed them. May 12. The warm weather has resulted in much greater depredations by the appletree tent-caterpillars, and in some places they are stripping the trees. May 19. Tent-caterpillars have done very much damage in both

Wyoming and Genesee counties, as shown by a recent trip; in some places the trees are entirely denuded. Cankerworms are very abundant, and, unless the trees are sprayed, many of them will be denuded of foliage. May 31.

Yates county (Cyrus R. Crosby, Penn Yan)—Appletrees are badly infested by aphids [*Aphis mali*], there being 20 to 30 lice on each bud. About 10% of the buds are infested with bud moth larvae [*Metocera ocellana*]. Mourning cloak butterflies [*Euvanessa antiopa*] are more abundant than usual. May 4. The grapevine flea beetle [*Haltica chalybea*] is doing very little damage. One vineyard of three acres which was badly affected two years ago, and in which they were very numerous last spring is entirely free now. The beetles were thoroughly picked last spring, and the leaves sprayed with paris green. May 11. The cold does not seem to have affected the appletree tent-caterpillars [*Clisiocampa americana*]. I have seen but one bunch of forest tent-caterpillars [*Clisiocampa disstria*]. May 12. Appletree tent-caterpillars are as abundant on the apple, peach and plum, as last year, but the forest tent-caterpillars appear to be far less numerous. May 18. Tent-caterpillars [probably both species] are doing damage everywhere. May 25. Tent-caterpillars are doing great damage to appletrees around Penn Yan, and some maples are as bare as in winter. June 2. I find a species of [*Xylina*] to be quite common on apricots as well as the plum curculio [*Conotrachelus nenuphar*]. June 9. Cankerworms are said to be doing considerable damage in the northern part of the county. I found several larvae [*Alypia octomaculata*] on grapes. June 15. I have found trouble in keeping the vinegar fly [*Drosophila ampelophila*] out of cheese case. July 2. The wheat in a great many fields is from one fourth to one half down as the result of the work of the Hessian fly, *Cecidomyia destructor*. July 13. Late peas are full of bugs [*Bruchus pisi*]. July 20.

LIST OF PUBLICATIONS OF THE ENTOMOLOGIST

The following is a list of the principal publications of the entomologist during the year 1900. 67 are named, with title,¹ place and time of publication and a summary of the contents of each. Volume and page numbers are separated by a colon, the first superior figure tells the column, and the second the exact place in the column in ninths; e. g. 63:993²³ means vol. 63, p. 993, column 2, beginning in the third ninth, i. e. about one third of the way down.

Memorial of life and entomologic work of Joseph Albert Lintner Ph.D. (Bul. N. Y. state mus. 5. no. 24. [issued 30 Oct. 1899] 316 p. 1 pl. Supplement to 14th rep't state entomol., 1898)

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Horse guard identified. (Country gentleman, 9 Nov. 1899, 64: 896³⁵)

Monedula carolina Fabr. is briefly noticed, and the trial of kerosene on pools for the destruction of horseflies is advised.

Entomology (University of the State of New York. Handbook 16. Oct. 1899 [issued 10 Nov.] 8p.)

A brief account of the office and its work.

Paint versus borers (Country gentleman, 16 Nov. 1899, 64: 917¹¹)

Gives several washes for borers, and states that brown or yellow paints would probably be better for ends of cut limbs than white lead.

Descriptive catalogue of insects exhibited at New York state farmers institutes. Formulas. [Issued 20 Nov.] 30p.

The more striking characteristics of about 100 injurious or beneficial insects are given briefly and methods of treatment outlined. The formulas of the more important insecticides are also given.

Diseased grape roots (Country gentleman, 23 Nov. 1899, 64: 930¹¹)

The galled, partly decayed roots have probably been attacked by phylloxera. Better material is requested.

¹ Titles are given as published, and in some instances they have been changed or supplied by the editors of the various papers.

- Voluntary entomologic service in New York state (U. S. dep't agric. Division of entomology. Bul. 20. 1899. n. ser. p. 39-43)
Describes the organization and operations of this force.
- Notes of the year for New York (U. S. dep't agric. Division of entomology. Bul. 20. 1899. n. ser. p. 60-62)
Records are given concerning the following: willow butterfly, *Euvanesa antiopa*, Linn.; flea beetles, *Systema frontalis*, Fabr., *S. hudsonias* Forst; forest tent-caterpillar, *Clisiocampa disstria* Hübn.; elm leaf beetle, *Galerucella luteola* Müll; asparagus beetles, *Crioceris 12-punctata* Linn., *C. asparagi* Linn.; and 17 year cicada, *Cicada septendecim* Linn.
- [Forest worms and birds] Dairyman [Franklin N. Y.] 22 Dec. 1899.
Lists birds feeding on forest tent-caterpillar, *Clisiocampa disstria* Hübn.
- Gipsy moth (Country gentleman, 8 Mar. 1900, 65: 196³⁴)
Gives a brief sketch of the work against *Porthetria dispar* Linn. and urges action by the federal government.
- Gipsy moth (Clinton [Mass.] courant, 10 Mar. 1900, p. 7)
A letter urging support of the excellent work against *Porthetria dispar* Linn.
- The forest tent-caterpillar (Country gentleman, 15 Mar. 1900, 65: 217¹⁷)
Gives observations on the abundance of the egg clusters of *Clisiocampa disstria* Hübn in various localities, describes the effect of attack by this insect on sugar maples and advises the destruction of eggs where practicable.
- Scale (American agriculturist, 4 Mar. 1900, 65: 375)
Identifies *Aspidiotus nerii* Bouché [hederae Vall.] and gives remedy.
- Forest tent-caterpillar (Argus [Albany] 25 Mar. 1900; New York farmer, 5 Ap. 1900, p. 6)
Recommending the collection and destruction of the more accessible eggs of *Clisiocampa disstria* Hübn.
- Buffalo tree-hopper (Country gentleman, 5 Ap. 1900, 65: 281²⁴)
Apple twigs from Loring (Kan.) have been injured by *Ceresa bubalus* Fabr. Habits and preventives given.
- Massachusetts will suffer first (Country gentleman, 5 Ap. 1900, 65: 283⁴)
Describes results if the gipsy moth, *Porthetria dispar* Linn., is simply controlled and not exterminated.
- Haystack moth (Country gentleman, 12 Ap. 1900, 65: 302¹⁶)
Identifies *Pyralis costalis* Fabr. from Welbourne (Va.) and gives remedies.

Scurfy bark louse (Country gentleman, 12 Ap. 1900, 65: 302³⁴)

Chionaspis furfura Fitch from New Dorp (N. Y.) is described and remedies are given.

Elm leaf beetle (American agriculturist, 14 Ap. 1900, 65: 483)

The distribution of *Galerucella luteola* Müll is given and arsenate of lead is recommended.

Insects injurious to maple trees (4th annual report of the commissioners of fisheries, game and forests of the state of New York. 1898 [issued March 1901] p. 367-95. Separate [issued 23 Ap. 1900] p. 31)

The transformations of insects are discussed briefly, followed by popular accounts, illustrated by three colored plates and 11 figures, of the following insects: white marked tussock moth, *Notolophus leucostigma* Abb. and Sm., forest tent-caterpillar or maple worm, *Clisiocampa disstria* Hübn., leopard moth, *Zeuzera pyrina* Fabr., maple Sesian, *Sesia acerni* Clem., sugar maple-borer, *Plagionotus speciosus* Say, maple-tree pruner, *Elaphidion villosum* Fabr. and the cottony mapletree scale insect, *Pulvinaria innumerabilis* Rathv., *Pimpla conquisitor* Say, *Pimpla inquisitor* Say, *Dibrachys boucheanus* Ratz., lunate long sting, *Thalessa lunator* Fabr., fiery ground beetle, *Calosoma calidum* Fabr. and the pigeon Tremex, *Tremex columba* Linn. are also figured and noticed as natural enemies of the preceding forms or as associated insects.

Hatching of tent-caterpillar eggs (Times-Union [Albany] 2 May 1900. p. 5. Rome [N. Y.] sentinel, 2 May 1900, p. 3. Argus [Albany] 3 May 1900, p. 3)

Gives notice of the eggs hatching and advises immediate spraying.

Voluntary entomologic service of New York (Country gentleman, 3 May 1900, 65: 363¹²; part in New York farmer, 3 May 1900, p. 5)

Abstract of reports from voluntary observers.

Control elm leaf beetle (Argus [Albany] 6 May 1900, p. 7)

General notice recommending spraying to prevent injuries by *Galerucella luteola* Müll.

[Shade tree insects] (Troy [N. Y.] budget, 6 May 1900)

Extracts from article noticing white marked tussock moth, *Notolophus leucostigma* Abb. and Sm., and forest tent-caterpillar, *Clisiocampa disstria* Hübn.

Voluntary entomologic service of New York (Country gentleman, 10 May 1900, 65:383¹⁸; New York farmer, 10 May 1900, p. 8)

Summary of reports from voluntary observers.

Cold and caterpillars (Argus [Albany] 13 May 1900, p. 7; American agriculturist, 26 May 1900, 65: 650)

Inelegant weather has only retarded the tent-caterpillars; spraying is urged.

- Voluntary entomologic service of New York (Country gentleman, 17 May 1900, 65: 403¹²)
Abstracts of reports from voluntary observers.
- Voluntary entomologic service of New York (Country gentleman, 24 May 1900, 65: 422⁴³-23¹¹)
Summary of reports from voluntary observers.
- Arsenate of lead for potatoes (Country gentleman, 24 May 1900, 65: 425⁴⁵)
Gives valuable features of arsenate of lead and method of preparation.
- Voluntary entomologic service of New York (Country gentleman, 31 May 1900, 65: 442³⁷)
Summary of reports from voluntary observers.
- Elm leaf aphid (Country gentleman, 7 June 1900, 65: 462²⁶)
Life history and habits of *Schizoneura americana* Riley.
- Voluntary entomologic service of New York (Country gentleman, 7 June 1900, 65: 462⁴⁹-63¹⁵)
Abstracts of reports from voluntary observers.
- Bees and spraying, a warning (Country gentleman, 7 June 1900, 65: 470²¹)
Gives fatal results supposed to have come from spraying trees in bloom within a few miles of apiaries.
- Elm leaf beetle (Argus [Albany] 10 June 1900, p. 7)
States that the larvae have begun feeding and gives formula for preparation of arsenate of lead.
- Voluntary entomologic service of New York (Country gentleman, 14 June 1900, 65: 483³⁴)
Summary of reports from voluntary observers.
- Caterpillars and cocoons (Times-Union [Albany] 20 June 1900, p. 4; Argus [Albany] 23 June 1900, p. 5; Country gentleman, 28 June 1900, 65: 526¹⁷-27¹²; New York farmer, 5 July 1900, p. 3; Waterloo [N. Y.] observer, 6 July 1900, p. 2; Northern budget [Troy N. Y.] 8 July 1900, p. 4)
Brief notice recommending the collection and destruction of forest tent-caterpillar, *Clisiocampa dissτρια* Hübn., cocoons.
- Rose beetle (Country gentleman, 21 June 1900, 65: 502²⁵)
Identifies and gives remedies for *Macrodactylus subspinosus* Fabr.
- Voluntary entomologic service of New York (Country gentleman, 21 June 1900, 65: 503²⁶)
Summary of reports from voluntary observers.

- White grubs in abundance (Country gentleman, 21 June 1900, 65: 509¹⁵)
Describes abundance of white grubs in Essex county and gives remedies.
- Voluntary entomologic service of New York (Country gentleman, 28 June 1900, 65: 523¹²)
Abstracts of reports from voluntary observers.
- Hickory gall aphid (Country gentleman, 5 July 1900, 65: 542⁴⁴)
Identifies and gives habits of *Phylloxera caryaecaulis*. Fitch.
- Voluntary entomologic service of New York (Country gentleman, 5 July 1900, 65: 543²⁴)
Summary of reports from voluntary observers.
- [Suffering sugar maple] (Country gentleman, 5 July 1900, 65: 545²²)
Describes the work of sugar maple-borer, *Plagionotus speciosus* Say, giving remedies. General directions for spraying are also given.
- Voluntary entomologic service of New York (Country gentleman, 12 July 1900, 65: 563³³)
Summary of reports from voluntary observers.
- Crude petroleum as an insecticide (Country gentleman, 12 July 1900, 65: 569³¹-70¹⁵)
Gives results of experiments and advises caution in using crude oil.
- Gold gilt beetle (Country gentleman, 19 July 1900, 65: 582⁴⁴)
Identifies *Chrysochus auratus* Fabr. and mentions *Pyrausta futilalis* Led.
- Voluntary entomologic service of New York state (Country gentleman, 19 July 1900, 65: 583²⁴)
Abstract of reports from voluntary observers.
- Report of committee on insects (Eastern New York hort. soc. Proc. 4th ann. meeting, 7 Feb. 1900 [Rec'd 24 July] p. 12-15)
Notices forest tent-caterpillar, *Clisiocampa disstria* Hübn., elm leaf beetle, *Galerucella luteola* Müll., sugar maple-borer, *Plagionotus speciosus* Say, leopard moth, *Zeuzera pyrina* Linn, willow butterfly, *Eu Vanessa antiopa* Linn., *Disonycha triangularis* Say, *Nectarophora destructor* Johns. [*N. pisi* Kalt.], *Phytoptus phloeocoptes* Nal. and *Opsicoetus personatus* Linn.
- Practical spraying (Country gentleman, 26 July 1900, 65: 604⁴³)
Gives results of practical spraying as carried out by a successful fruit-grower.
- Tent-caterpillars and cankerworms (Country gentleman, 26 July 1900, 65: 605¹¹)
Gives characteristics and methods of controlling *Clisiocampa americana* Fabr., *C. disstria* Hübn. and cankerworms.

15th report of the state entomologist on injurious and other insects of the state of New York 1899 (Bul. N. Y. state mus. June 1900. [Issued 31 July 1900] v. 6, no. 31, p. 531-653)

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Plugging trees with sulfur (Country gentleman, 9 Aug. 1900, 65: 650¹⁴)

A brief historical sketch of this method, condemning it as worthless.

Cicada-killer (Country gentleman, 16 Aug. 1900, 65: 662¹⁷)

Brief, popular notice of *Sphecius speciosus* Drury.

Asparagus beetle (Country gentleman, 16 Aug. 1900, 65: 662²⁶)

Crioceris asparagi Linn. is identified, figured and remedies given.

Appletree worm (Country gentleman, 6 Sep. 1900, 65: 722²¹)

Datana ministra Drury is identified, life history given and remedies indicated.

- Ash gray blister beetle (Country gentleman, 6 Sep. 1900, 65: 722³³)
Remedies are given for the depredations of *Epicauta cinerea* Forst. on *Clematis paniculata*.
- Tulip tree scale (Country gentleman, 6 Sep. 1900, 65: 722³⁶)
The treatment is given for *Lecanium tulipiferae* Cook on tulip trees.
- Cicada-killer (Country gentleman, 6 Sep. 1900, 65: 722⁴¹)
Sphecius speciosus Drury is identified from a specimen sent.
- Black blister beetle (Country gentleman, 13 Sep. 1900, 65: 742⁴⁵)
Identifying *Epicauta pennsylvanica* DeGeer.
- Mating of potato beetles (Country gentleman, 13 Sep. 1900, 65: 743¹⁷)
Discusses briefly the sexual relations and prolificacy of the Colorado potato beetle.
- Chinch bug abundant (Country gentleman, 13 Sep. 1900, 65: 750²¹)
Gives directions for controlling *Blissus leucopterus* Say, which was abundant at Peruville (N. Y.)
- Illustrated descriptive catalogue of some of the more important injurious and beneficial insects (Bul. N. Y. state mus. [issued 14 Sep. 1900] v. 8, no. 37, 54p. 83 fig.)
Gives the chief characteristics of about 100 of the more important insects. Methods of controlling injurious forms are given, also the formulas of many insecticides.
- Katydid eggs (Country gentleman, 27 Sep. 1900, 65: 782⁴⁵)
Brief, popular account of *Microcentrum retinervis* Burm.
- Infestation by grain moths (Country gentleman, 27 Sep. 1900, 65: 789²³)
General accounts of the Angoumois moth, *Sitotroga cerealella* Oliv., and of the Mediterranean flour moth *Ephestia kuehniella* Zell.
- White grubs or muckworms (Country gentleman, 4 Oct. 1900, 65: 803¹²)
Brief account of *Allorhina* and *Lachnosterna* larvae, giving remedies.
- Chrysalis of milkweed butterfly (Country gentleman, 11 Oct. 1900, 65: 829⁴¹)
Describes the chrysalis and gives briefly the life history of *Anosia plexippus* Linn.
- Borer in the smoke tree (American gardening, 13 Oct. 1900, 21: 679¹¹)
The effects stated indicate the presence of a borer, possibly the leopard moth, *Zeuzera pyrina* Linn.

CONTRIBUTIONS TO COLLECTION 15 OCT. 1899 — 14
OCT. 1900

Hymenoptera

Xylocopa virginica Drury, large carpenter bee, 31 May; from **W. C. Hitchcock**, Cropseyville N. Y.

Apis mellifica Linn., honeybee, 5 July; from Mrs **E. B. Smith**, Coeymans N. Y.

Xenoglossa pruinosa Say, 24 July; from Mrs **E. C. Anthony**, Gouverneur N. Y.

Sphecius speciosus Drury, cicada-killer, 28 Aug.; from *Country gentleman*, Albany N. Y.

Pelecinus polyturator Drury, 5 Oct.; from **M. E. Myer**, Stottville N. Y.

Melanobracon simplex Cress., probably parasitic on *Saperda tridentata*, pupa found under elm bark, 20 Oct. 1898; from **J. A. Otterson**, Berlin Mass.

Pimpla conquisitor Say, working as parasite on cocoons of *Clisiocampa disstria* Hübn., 18 June; from **Daniel Bennett**, Delmar N. Y.

Pimpla inquisitor Say, 5 July; from Mrs **E. B. Smith**, Coeymans N. Y.

Theronia fulvescens Cress., from about *Clisiocampa disstria* Hübn. cocoons, 18 June; from **Daniel Bennett**, Delmar N. Y.

Thalessa atrata Fabr., black long sting, 18 June; from **E. P. St John**, Prattsburg N. Y. Same, 26 July; from Mrs **E. H. Mairs** Irvington N. Y.

Paniscus gemminatus Say, 28 Oct.; from **L. V. Case**, Bedford N. Y.

Cynips strobilana O. S., on swamp oak (*Quercus bicolor*), 27 Sep.; from **M. W. Van Denburg**, Mount Vernon N. Y.

Tremex columba Linn., pigeon Tremex, 10 Aug.; from **M. B. Sherman**, Ogdensburg N. Y. Same, 15 Oct.; from **O. Q. Flint**, Athens N. Y.

Urocerus albicornis Fabr., 25 Sep.; from **F. B. Durant**, Watervliet N. Y. This insect had bored through spruce boards of box and then penetrated 10-12 thicknesses of woolen cloth.

Lophyrus lecontei Fitch, LeConte's sawfly, larvae on white pine, 6 Aug.; from **B. E. Fernow**, Axton N. Y.

Coleoptera

Dendroctonus terebrans Oliv., 18 June; from **E. S. Blunt**, New Russia N. Y.

Scolytus rugulosus Ratz., peach bark-borer, on cherry and peach, 8 Nov.; from **C. H. Peck**, Menands N. Y. Same on peach, 10 Sep.; from **J. J. Barden**, Stanley N. Y. Same on cherry, 24 Sep.; from **B. H. Wright**, Penn Yan N. Y. Work of same on pear, 7 Ap.; from Mrs **E. B. Smith**, Coeymans N. Y.

Coeliodes species, 9 June; from **C. R. Crosby**, Penn Yan N. Y.

Conotrachelus crataegi Walsh, quince curculio, and *C. nenuphar* Hbst., plum curculio, 6 June; from **J. F. Hunt**, Kendaia N. Y. *C. nenuphar* Hbst., 9 June; from **C. R. Crosby**, Penn Yan N. Y.

Magdalis armicollis Say and *M. barbata* Say, elm curculios, in all stages, 26 May; from **M. F. Adams**, Buffalo N. Y.

Lixus concavus Say, rhubarb curculio, 26 May; from **C. E. Chapman**, Peruville N. Y.

Aramigus fulleri Horn, Fuller's rose beetle, on carnations, 18; Oct.; from **D. H. Burrell jr**, Littlefalls N. Y.

Pomphopoea sayi Lec., Say's blister beetle, on peach, 26 June; from **E. L. Mitchell**, Clarksville N. Y.

Epicauta pennsylvanica DeGeer, black blister beetle, 28 Aug.; from **Daniel Beach**, Watkins N. Y. Same, Aug.-Sep.; from Mrs **E. B. Smith**, Coeymans N. Y.

Epicauta cinerea Forst., margined blister beetle, 25 June; from Mrs **H. D. Graves**, Ausable Forks N. Y. Same on beet, 10 July; from **C. L. Allen**, Floral Park N. Y. Same, 18 Aug.; from Mrs **E. B. Smith**, Coeymans N. Y. Same, 28 Aug.; from *Country gentleman*, Albany N. Y.

Notoxus anchora Hentz., on pea, 25 June; from Mrs **H. D. Graves**, Ausable Forks N. Y.

Tribolium confusum Duv., confused flour beetle, in wheat flour and granaries, 21 Ap.; from **Grigg Bros.**, Lockport N. Y.

Tenebrio molitor Linn, meal worm, 11 Sep.; from **J. A. Otterson**, Berlin Mass. Same, 18 Aug.; from Mrs **E. B. Smith**, Coeymans N. Y.

Tenebrio obscurus Fabr., American meal worm, killed by *Opsicoetus personatus*, 19 July; from **A. N. Henshaw**, Prattsburg N. Y.

Bruchus obtectus Say, bean weevil, abundant in house, 10 Aug.; from **Alonzo McCCase**, Amsterdam N. Y.

Chelymopha argus Licht., Argus tortoise beetle, pupae, 4 Aug.; from Mrs **M. S. Miller**, Aldercreek N. Y.

Coptocycla clavata Fabr., clubbed tortoise beetle, 5 July and 18 Aug.; from Mrs **E. B. Smith**, Coeymans N. Y.

Systema taeniata Say, pale striped flea beetle, 14 June; from Newark N. Y. through state department of agriculture. Same on apple seedlings, 27 June; from **C. H. Stuart**, Newark N. Y.

Oedionychis 6-maculata Ill., on ash tree, 23 Aug.; from **H. M. Smith**, North Hector N. Y.

Larvae of *Galerucella luteola* Müll., elm leaf beetle, on elm, 3 July; from **O. Q. Flint**, Athens N. Y.

Diabrotica 12-punctata Oliv., 12 spotted Diabrotica, 26 June; from **C. E. Chapman**, Peruville N. Y. Same, Aug.-Sep.; from Mrs **E. B. Smith**, Coeymans N. Y.

Crioceris 12-punctata Linn., 12 spotted asparagus beetle, 16 June; from **H. M. Smith**, North Hector N. Y. Same, 1 Aug; from **C. H. Peck**, Menands N. Y. Same, 18 Aug.; from Mrs **E. B. Smith**, Coeymans N. Y.

Crioceris asparagi Linn., common asparagus beetle, adult and eggs, 17 May; from **H. M. Smith**, North Hector N. Y. Adult of same, 25 May; from **R. Schofield**, Dormansville N. Y. Same, 31 July; from Mrs **C. P. Williams**, Salisbury Center N. Y.

Tetraopes tetraophthalmus Forst., spotted milkweed beetle, 12 July; from **H. M. Smith**, North Hector N. Y.

Saperda puncticollis Say, bred by donor, contributed 3 Nov. and 10 July; from **L. H. Joutel**, New York city. *Saperda discoidea* Fabr., 10 July; from the same.

Saperda tridentata Oliv., elm tree-borer, in all stages, 26 May; from **M. F. Adams**, Buffalo N. Y.

Goes ?pulchra Hald., 2 July; from **C. H. Peck**, Menands N. Y.

Monohammus confusor Kirby, long-horned pine-borer, 30 June; from **Marvin Callan**, Albany N. Y. Same, 6 July; from **F. J. Conely**, Albany N. Y. Same, 10 July; from **Arthur Miller**, Ravenna N. Y. Same, 20 July; from **Frank Riley**, Albany N. Y. Same, 23 July; from **H. M. Pollock**, Albany N. Y.

Monohammus scutellatus Say, 21 July; from **C. H. Peck**, North Elba N. Y.

Desmocerus palliatus Forst., cloaked knotty horn, 6 June; from **Augustus Sickinger**, Albany N. Y.

Xylotrechus sagittatus Germ., on *Carpinus betuli*, 16 July; from **M. F. Adams**, Buffalo N. Y.

Plagionotus speciosus Say, sugar maple-borer, 28 June; from Mrs **William Barnes**, Albany N. Y.

Cyllene pictus Drury, hickory-borer, 4 May; from **J. A. Ottersen**, Berlin Mass.

Callidium antennatum Newm., 18 June; from **E. S. Blunt**, New Russia N. Y.

Orthosoma brunneum Forst., straight-bodied Prionid, 29 Aug.; from **G. S. Graves**, Newport N. Y.

Osmoderma eremicola Knoch and *O. scabra* Beauv., rough flower beetle, also *Euphoria inda* Linn., bumble flower beetle, 18 Aug.; from Mrs **E. B. Smith**, Coeymans N. Y.

Allorhina nitida Linn., green June beetle, 3 July; from Mrs **M. A. Knickerbocker**, Douglaston N. Y.

Larvae of *Ligyris relictus* Say, 8 June; from **C. H. Peck**, Menands N. Y.

Pelidnota punctata Linn., spotted grapevine beetle, on grape, 12 July; from Mrs **D. D. Curtis**, Sidney Center N. Y. Same, 26 July; from Mrs **E. H. Mairs**, Irvington N. Y. Same, 27 July; from **Francis Drake**, Albany N. Y. Same, 18 Aug.; from Mrs **E. B. Smith**, Coeymans N. Y.

Anomala lucicola Fabr., light-loving grapevine beetle, 3 July; from **C. H. Peck**, Menands N. Y.

Macrodactylus subspinosus Fabr., rose beetle, 30 June; from **C. L. Williams**, Glens Falls N. Y.

Ennearthron thoracicornis Zeigl. on *Polyporus annosus*, 6 July; from Washington D. C. through **C. H. Peck**, Menands N. Y.

Lasioderma testaceum Duft., cigarette beetle, larvae in cut plug tobacco, 16 May; from **J. M. Clarke**, at Canandaigua N. Y.

Corymbites vernalis Hentz., 31 May; from **D. B. Young**, Newport N. Y.

Limonius confusus Lec., 18 June; from **E. S. Blunt**, New Russia N. Y.

Alaus oculatus Linn., owl beetle, 7 June; from **O. Q. Flint**, Athens N. Y. Same, 16 June; from **M. B. Sherman**, Ogdensburg N. Y. Same, 19 July; from **W. H. Coleman**, Albany N. Y. Same, 12 June; from **Rhoda Thompson**, Ballston Spa N. Y.

Adelocera brevicornis Lec., 28 June; from **E. S. Blunt**, New Russia N. Y.

Silvanus surinamensis Linn., saw-toothed grain beetle, infesting wheat flour and granaries, 21 Ap.; from **Grigg Bros.**, Lockport N. Y.

Adalia bipunctata Linn., two spotted lady bug, pupae and adults, 25 June; from **Henry Wheeler**, Troy N. Y. Same, 5 July and 18 Aug.; from Mrs **E. B. Smith**, Coeymans N. Y.

Megilla maculata DeGeer, spotted lady bug, in numbers on the ground, 19 Ap.; from **John Babcock**, Selkirk N. Y. Same, 25 May; from **R. Schofield**, Dormansville N. Y.

Necrophorus marginatus Fabr., 18 Aug.; from Mrs **E. B. Smith**, Coeymans N. Y.

Dytiscus fasciventris Say, diving beetle, 17 Ap.; from **Eleanor Slingerland**, Albany N. Y.

Calosoma scrutator Fabr., ground beetle, 17 June; from **F. B. Robinson**, Newburgh N. Y. through **Dr Merrill**. Same, 27 July; from **Francis Drake**, Albany N. Y.

Siphonaptera

Ceratopsyllus serraticeps Gerv., dog flea, 6 Nov.; from **S. A. Russell**, Poughkeepsie N. Y.

Diptera

Drosophila ampelophila Loew, pickled-fruit fly, 2 July; from **C. R. Crosby**, Penn Yan N. Y.

Sarcophaga species, unusually abundant in woods where *Clisio-campas* have been numerous, 26 June; from **E. L. Mitchell**, Clarks-ville N. Y.

Argyramoeba simson Fabr. and *Chrysops niger* Macq., 18 Aug.; from Mrs **E. B. Smith**, Coeymans N. Y.

Sciara species, hair worm or snakeworm in "snake" form, 24 July from **C. A. Chamberlain**, Franklin N. Y.

Lasioptera vitis O. S., grapevine gall midge, on wild grape, 9 Aug.; from **C. R. Crosby**, Penn Yan N. Y.

Lepidoptera

Anosia plexippus Linn., milkweed butterfly, 14 Aug.; from Mrs **M. S. Miller**, Aldercreek N. Y. Same, 6 Oct.; from **W. C. Hitchcock**, Cropseyville N. Y. Chrysalis of same, 15 Oct.; from **O. Q. Flint**, Athens N. Y.

Argynnis cybele Fabr., great spangled fritillary, 29 Aug.; from **G. S. Graves**, Newport N. Y.

Argynnis ?aphrodite Fabr., *Phyciodes tharos* Drury, pearl crescent, *Heodes hypophlaeas* Boisd., American copper, 6 Oct.; *Brenthis bellona* Fabr., meadow fritillary, 31 May; all from **W. C. Hitchcock**, Cropseyville N. Y.

Eu Vanessa antiopa Linn., willow butterfly, pupa, 18 June; from **J. C. Van Steenburgh**, Ballston Spa N. Y.

Pyrameis atalanta Linn., red admiral, 31 May; *Cyaniris pseudargiolus* Bd.-Lec. var. *neglecta* Edw., spring azure, 6 Oct.; *Pieris rapae* Linn., cabbage butterfly, 31 May and 6 Oct.; *Eurymus philodice* Godt., clouded sulfur, 31 May; all from **W. C. Hitchcock**, Cropseyville N. Y.

Laertias philenor Linn., blue swallowtail, on Dutchman's pipe (*Aristolochia siphon*), 10 Aug.; from Mrs **C. J. Gould**, Tarrytown N. Y.

Euphœades troilus Linn., green swallowtail, 31 May; from **W. C. Hitchcock**, Cropseyville N. Y. Same and *Papilio polyxenes* Fabr., black swallowtail, Aug.-Sep.; from Mrs **E. B. Smith**, Coeymans N. Y.

Heraclides crespontes Cram., yellow banded swallowtail, on *Fraxinella*, 14 July; from **F. J. H. Merrill**, Altamont N. Y.

Thyreus abbotii Swains, larva, 9 July; from **Howard Martin**, Albany N. Y.

Philampelus pandorus Hübn., 28 Aug.; from **C. A. Chamberlain**, Franklin N. Y.

Ampelophaga myron Cram., grapevine hog caterpillar, parasitized by *Apanteles congregatus*, 29 Aug.; from **Rhoda Thompson**, Ballston Spa N. Y.

Phlegethontius celeus Hübn., tomato worm, 26 July; from Mrs **E. H. Mairs**, Irvington N. Y.

Sphinx kalmiae Abb. and Sm., 27 July; from **Francis Drake**, Albany N. Y.

Alypia octomaculata Fabr., eight spotted forester, 7 June; from **O. Q. Flint**, Athens N. Y. Larvae of same, 15 June; from **C. R. Crosby**, Penn Yan N. Y.

Ctenucha virginica Charp., 6 Oct.; from **W. C. Hitchcock**, Cropseyville N. Y.

Larvae of *Hyphantria cunea* Drury, fall webworm, on elm, 19 July; larvae and eggs of *Notolophus antiqua* Linn., 14 July; from **M. B. Sherman**, Ogdensburg N. Y.

Eggs of *Notolophus leucostigma* Abb. and Sm., white marked tussock moth, 27 Ap.; from **G. S. Graves**, Newport N. Y. Larvae of same, 12 July; from **H. M. Smith**, North Hector N. Y.

Sibine stimulea Clem., saddleback caterpillar, on corn, 3 Sep.; from **S. L. Seaman**, Babylon N. Y.

Thyridopteryx ephemeraeformis Haw., bag worm larvae, 28 June; from **W. T. Davis**, New York city.

Larvae of *Datana integerrima* Gr. and Rob., on black walnut, 28 Aug.; from **J. M. Smith**, Binghamton N. Y.

Schizura concinna Abb. and Sm., red-humped appletree caterpillar, 28 Aug.; from **H. Cady**, Schoharie N. Y.

Callosamia promethea Drury, Promethea moth, 28 Aug.; from **A. H. Stratton**, Arlington N. Y. Cocoons of same, 10 Nov.; from **F. H. Fellows**, Albany N. Y.

Samia cecropia Linn., Cecropia moth, 7 June; from **O. Q. Flint**, Athens N. Y.

Tropaea luna Linn., luna moth, 25 June; from **G. H. Malloy**, Albany N. Y.

Telea polyphemus Cram., Polyphemus moth, 31 May; with *Automeris io* Fabr., Io moth, 6 Oct.; all from **W. C. Hitchcock**, Cropseyville N. Y. Eggs and adult of latter moth also, 27 June; from Mrs **M. S. Miller**, Aldercreek N. Y.

Citheronia regalis Fabr., regal moth, 16 July; from **O. Q. Flint**, Athens N. Y.

Anisota rubicunda Fabr., rosy Dryocampa, 11 Sep.; from **J. A. Otterson**, Berlin Mass.

Clisiocampa disstria Hübn., forest tent-caterpillar, and *Clisiocampa americana* Fabr., appletree tent-caterpillar, eggs of both, 13 Nov.; from **S. D. Willard**, Geneva N. Y. through state department of agriculture. Eggs and larvae 11 May; from **A. G. Meiklejohn**, Plattsburg N. Y. Eggs, 25 Ap.; and moths, 5 July; from Mrs **E. B. Smith**, Coeymans N. Y. Eggs of *C. americana* Fabr., on peach, 3 July; from **O. Q. Flint**, Athens N. Y. Eggs of *C. disstria* Hübn., on pear, 10 Nov.; from **F. H. Fellows**, Albany N. Y. Same, 7 Ap.; from **G. S. Graves**, Newport N. Y. Same, 9 Ap.; from **R. Schofield**, Dormansville N. Y. Same, 16 Ap.; from **D. W. Bennett**, New Salem N. Y. Larvae of same, 18 May; from **H. M.**

Smith, North Hector N. Y. Cocoons of same, over 90% of which were parasitized, 7 July; from **J. W. McNamara**, Altamont N. Y.

Prionoxystus robiniae Peck, oak carpenter moth, in sugar maple, pupa cases, 18 June and 10 Aug.; adult, 2 July; and larvae 10 Oct.; all from **M. B. Sherman**, Ogdensburg N. Y.

Leucania pseudargyria Guen., *L. phragmitidicola* Guen., *Feltia subgothica* Haw., *Xylophasia dubitans* Walk., 18 Aug.; all from Mrs **E. B. Smith**, Coeymans N. Y.

Xylophasia arctica Boisd., 1 Aug.; from **Virgil Bogue**, Albion N. Y.

Laphygma frugiperda Abb. and Sm., larvae and pupae, 4 Nov.; moth, 13 Nov.; from **M. F. Adams**, Buffalo N. Y.

Hydroecia nitela Guen., stalk-borer, larvae, 19 June; from **W. C. Hitchcock**, Cropseyville N. Y. Same, 3 July; from **J. S. Ellsworth**, Millerton N. Y.

Xylina species, larva, 9 June and *Amphipyra pyramidoides* Guen., larva, 4 June; from **C. R. Crosby**, Penn Yan N. Y. The latter also, 18 June; from **E. P. St John**, Prattsburg N. Y.

Larvae of *Plusiodonta compressipalpis* Guen., on moon-seed vine, 9 July and 29 Aug.; from Mrs **E. C. Anthony**, Gouverneur N. Y.

Larvae of *Acontia delecta* Walk., on swamp rose mallow (*Hibiscus moscheutos*), 13 Aug.; from **L. H. Joutel**, New York city.

Catocala ilia Cram., *C. habilis* Grote, *C. subnata* Grote, *C. resecta* Grote, 28 Aug.; all from **J. M. Smith**, Binghamton N. Y.

Sabulodes transversata Drury, Sep.; *Cleora crepuscularia* Guen., 5 July; *Eustroma diversilineatum* Hübn., 18 Aug.; all from Mrs **E. B. Smith**, Coeymans N. Y.

Rhaphidodemas titea Cram. and *Paleacrita vernata* Harr., spring cankerworm, 26 Ap.; from **M. B. Sherman**, Ogdensburg N. Y.

Haematopis grataria Fabr., 7 June; from **H. M. Smith**, North Hector N. Y. Same, 6 Oct.; from **W. C. Hitchcock**, Cropseyville N. Y.

Pyralis farinalis Linn., 18 Aug.; from Mrs **E. B. Smith**, Coeymans N. Y.

Larvae of *Oxyptilus periscelidactylus* Fitch, grapevine plume moth, 2 June; and larvae of *Cacoecia* species and of *Tmetocera ocellana* Schiff., bud moth, on pear, 23 May;

all from **C. H. Peck**, Menands N. Y. *T. ocellana*, 27 Ap.; from **F. H. Fellows**, Albany N. Y. Same on apple, 8 May; from **J. P. Van Ness**, East Greenbush N. Y.

Larvae and work of *Ypsolophus pometellus* Harr., palmer worm, 18 June; from **J. F. Rose**, South Byron N. Y. Same on apple, more numerous and harmful than *Clisiocampa* larvae at this time 26 and 30 June; from **E. L. Mitchell**, Clarksville N. Y.

Larvae of *Coleophora malivorella* Riley, pistol case, bearer, on apple, 8 May; from **J. P. Van Ness**, East Greenbush N. Y.

Tischeria malifoliella Clem., apple leaf-miner, 26 Sep.; from **C. M. Hooker**, Rochester N. Y. A parasite was obtained. Larvae of the miner on apple, with work of *Aspidisca splendiferella* Clem., resplendent shield-bearer, on apple and quince leaves, 4 Nov.; from **C. H. Peck**, Menands N. Y.

Neuroptea

Chrysopa eggs, 16 June; from **Rhoda Thompson**, Ballston Spa N. Y.

Sialis pinfumata Newm., 9 June; from **C. L. Williams**, Glens Falls N. Y.

Corydalis cornuta Linn., horned *Corydalis*, 10 July; from **Ogden Stevens**, Athol N. Y., through **M. H. Farr**. Same, 12 July; from **O. Q. Flint**, Athens N. Y. Same, 20 July; from **E. H. Harris**, Albany N. Y., and from **A. H. Miller**, Ravena N. Y. Same 28 July; from **William Cody**, Albany N. Y.

Polystoechotes punctatus Fabr., 17 Aug.; from **Virgil Bogue**, Albion N. Y., and from **F. P. Warren**, Pike N. Y.

Hemiptera

Podisus spinosus Dall., spined soldier bug, 15 May; from **C. H. Stuart**, Newark N. Y.

Brochymena annulata Fabr., 7 June; from **H. M. Smith**, North Hector N. Y.

Pentatoma juniperina Linn., juniper plant bug, 28 June; from **E. S. Blunt**, New Russia N. Y.

Nezara hilaris Say, 5 July; and *Anasa tristis* DeGeer, squash bug, Aug.; from Mrs **E. B. Smith**, Coeymans N. Y. Eggs and nymphs of latter, 4 Aug.; from **Rhoda Thompson**, Ballston Spa N. Y.

Blissus leucopterus Say, chinch bug, abundant on corn, 8 Sep.; from **C. E. Chapman**, Peruville N. Y.

Oncopeltus fasciatus Dall., 8 Oct.; from **M. W. Van Denberg**, Mount Vernon N. Y.

Poecilocapsus lineatus Fabr., four-lined leaf bug, 5 July; from Mrs **E. B. Smith**, Coeymans N. Y.

?*Acholla multispinosa* DeGeer, 26 Mar.; from **Henry Lutts**, Youngstown N. Y.

Opsicoetus personatus Linn., masked bedbug hunter, "kissing bug," adult with eggs, 2 July; from **J. N. Wright**, Grand Gorge N. Y. Same with adult *Tenebrio obscurus* killed by it, 19 July; from **A. N. Henshaw**, Prattsburg N. Y.

Belostoma americanum Leidy, giant water bug, 14 May; from **Peter Made**, Albany N. Y. Same, 15 May; from **Freddie Messer**, Albany N. Y.

Benacus griseus Say, 25 May; from **William Walsh**, Albany N. Y.

Cicada tibicen Linn., dog day harvest fly, 1 Aug.; from **Virgil Bogue**, Albion N. Y.

Twigs showing oviposition of *Ceresa bubalus* Fabr., 28 May; from **W. W. Chadwick**, Loring Kan.

Telamona ampelopsidis Harr., woodbine Telamona, 6 Oct.; from **W. C. Hitchcock**, Cropseyville N. Y.

Nymphs of *Ormenis pruinosa* Say, 10 July; from **J. M. Smith**, Binghamton N. Y.

Idiocerus pallidus Fitch, *I. suturalis* Fitch, *I. alternatus* Fitch, *I. lachrymalis* Fitch, *I. maculipennis* Fitch, *Pediopsis trimaculata* Fitch, *Acocephalus vitellinus* Fitch, *Athysanus curtisii* Fitch, *Eutettix strobi* Fitch, all received 18 Aug.; from **C. P. Gillette**, Fort Collins Col.

Psylla pyricola Forst., pear psylla, nymphs and adults on pear, 8 May; from **Henry Lutts**, Youngstown N. Y.

Chermes abietis Linn., with insects emerging from galls, 25 Sep.; from Mrs **E. C. Anthony**, Gouverneur N. Y.

Leaves of balm of gilead almost bordered with galls of *Pemphigus populi-monilis* Riley, 7 Aug.; from Mrs **M. S. Miller**, Aldercreek N. Y.

Schizoneura lanigera Hausm., woolly apple aphid, in tops of trees and on roots of young nursery stock, 13 Nov.; from **S. D. Willard**, Geneva N. Y., through state department of agriculture. Same, 5 Oct.; from **G. S. Graves**, Newport N. Y.

Schizoneura americana Riley, on elm, 14 June; from **Charles Burke**, Troy N. Y., through state department of agriculture. Same, 27 June; from **Mrs M. S. Miller**, Aldercreek N. Y. Same, 17 Sep.; from **J. M. Smith**, Binghamton N. Y.

Aphis mali Fabr., apple aphis, 26 Ap.; from **H. M. Smith**, North Hector N. Y. Same, on apple, 3 May; from **J. P. Van Ness**, East Greenbush N. Y. Same, 16 June; from **Rhoda Thompson**, Ballston Spa N. Y.

Myzus cerasi Fabr., cherrytree aphis, on cherry, 3 July; from **O. Q. Flint**, Athens N. Y.

Nectarophorapisi Kalt., destructive pea louse, on pea, 2 July; from **C. L. Allen**, Floral Park N. Y.

Phylloxera caryaecaulis Fitch, hickory gall aphid, from **J. H. Hull**, Croton N. Y.

Gossyparia ulmi Geoff., elm bark louse, on elm, 14 Aug.; from **M. B. Sherman**, Ogdensburg N. Y.

Lecanium species on elm, 16 July; from same.

Lecanium ?cerasifex Fitch on apple, 14 Dec.; from **J. J. Barden**, Union Springs N. Y.

Lecanium tulipiferae Cook, tulip tree scale, on tulip tree, 27 Aug.; from **W. T.**, Concordville Pa. Same with young just beginning to appear, 4 Sep.; from **M. W. Van Denberg**, Mount Vernon N. Y.

Aspidiotus hederæ Vall., white scale, 14 Feb.; from **George Roberts**, Jellwood Fla.

Aspidiotus ancyclus Putn., 9 Ap.; from **Morris Tompkins**, Germantown N. Y. Same, 31 May; from **Chester Young**, Ellenville N. Y., through state department of agriculture.

Aspidiotus forbesi Johns., cherry scale, on apricot, 4 Mar.; from **F. S. Lockling**, Fruitdale Ala., received 16 July, through division of entomology, U. S. department of agriculture. Same on apple; 18 Aug.; from **P. L. Husted**, Manchester N. Y.

Aspidiotus perniciosus Comst., San José scale, 16 Jan.; from **Frederick Kropp**, Wantagh N. Y. Same, 28 Mar.; from **Charles Brink**, Cockburn N. Y. Same, on under side of apple limb 4 inches in diameter, 7 Ap.; from **L. L. Morrell**, Kinderhook N. Y. Probably same, 19 Ap.; on stock shipped to **H. S. Taylor & Co.**, Rochester N. Y., by **W. M. Ride**, Crystalspring Pa. Received through state department of agriculture.

Aspidiotus ostreaeformis Curtis, 23 May; from **Henry Lutts**, Youngstown N. Y.

Howardia elegans Leon., on leaflets and incrusting midrib of leaf of *Cycas revoluta*, 21 Sep.; from **F. J. H. Merrill**, Alton N. Y.

Xerophilaspis prosopsideis Ckll., on *Prosopis velutina*, 15 Sep.; from **T. D. A. Cockerell**, East Las Vegas N. M.

Mytilaspis pomorum Bouché, appletree bark louse, on lilac, 31 Oct.; from **F. W. Kelsey**, New York city. Same, abundant and injurious on young orchard trees, 13 Nov.; from **S. D. Willard**, Geneva N. Y., through state department of agriculture. Same, on *Cornus alternifolia*, 21 Nov.; from **G. S. Graves**, Newport N. Y. Same, 13 Feb.; from **J. P. Becker**, Pleasantbrook N. Y. Same, on apple, 23 Ap.; from Mrs **A. E. Wilson**, Shushan N. Y. Same, 25 May and 1 June; from **J. F. Johnson**, Breakabeen N. Y. Same, 1 June; from **M. B. Sherman**, Ogdensburg N. Y. Same, 2 June; from **O. J. Hutchins**, Ogdensburg N. Y. Same, on Siberian willow, 9 Aug.; from **J. M. Dolph**, Port Jervis N. Y.

Chionaspis furfura Fitch, scurty bark louse, on cuttings with 300 trees found infested in one nursery and 500 in another, 13 Nov.; from **S. D. Willard**, Geneva N. Y., through state department of agriculture. Same, 30 Mar.; from **T. L. Meinikheim**, Newdorp N. Y. Same, 26 Ap.; from **J. M. Dolph**, Port Jervis N. Y.

Aulacaspis rosae Sandb., rose scale, on blackberry bushes, 21 Nov.; from **H. C. Peck**, Brighton N. Y., through state department of agriculture.

Orthoptera

Amblycorypha oblongifolia DeGeer, oblong leaf-winged katydid, 18 Aug.; from Mrs **E. B. Smith**, Coeymans N. Y.

Conocèphalus ensiger Harr., cone-headed katydid, 26 July; from **H. M. Pollock**, Albany N. Y. Same, 31 July; from **Thomas Andrews**, Albany N. Y.

Melanoplus femur-rubrum DeGeer, red-legged locust, *Stenobothrus* species, and *Dissosteira carolina* Linn., Carolina locust, 4 Aug.; all from **W. C. Hitchcock**, Cropseyville N. Y.

Several specimens of the last found dead, filled with fungus spores of *Massospora cicadina* Peck, 16 June; from **George Staplin jr**, Mannsville N. Y. Also one, Aug., with *Diapheromera femorata* Say, walking stick, from Mrs **E. B. Smith**, Coeymans N. Y. The latter also, 11 Sep.; from **J. A. Otterson**, Berlin Mass.

Ischnoptera pennsylvanica DeGeer, wood cockroach, adults under decaying bark, June; from **D. B. Young**, Ilion N. Y.

Corrodentia

Atropos divinatoria O. Fabr., book louse, badly infesting closet, 5 Oct.; from **C. C. Mosely**, Albany N. Y.

Odonata

Agrion species, damsel fly, 16 June; from **Rhoda Thompson**, Ballston Spa N. Y.

Ephemerida

May flies, 8 June; from **M. B. Sherman**, Ogdensburg N. Y. Same, 17 June; from **H. M. Smith**, North Hector N. Y.

Arachnida

Spiders' eggs, 26 Mar.; from **Henry Lutts**, Youngstown N. Y. Same, 20 Ap.; from **O. Q. Flint**, Athens N. Y.

Phytoptus ? phloeocoptes Nal., 8 May; from **P. L. Husted**, Blauvelt N. Y. Same, 6 Dec.; from same, at Troy and Marlboro N. Y.

EXPLANATION OF PLATES

PLATE 1^a**Gipsy moth**

PORTHETRIA DISPAR Linn.

FIG.

- 1 Female with wings expanded
- 2 Female in resting position
- 3 Male with wings expanded
- 4 Male in resting position
- 5 Pupa
- 6 Dorsal view of one of the larger caterpillars, presumably a female
- 7 Dorsal view of one of the smaller full-grown caterpillars, presumably a male
- 8 Egg cluster on a piece of bark
- 9 A few eggs greatly enlarged
- 10 One egg still more enlarged

PLATE 2^b**Palmer worm**

YPSOLOPHUS POMETELLUS Harris

FIG.

- 1 Full-grown larva, much enlarged
- 2 Pupa, much enlarged
- 3 Typical form of moth enlarged
- 4 Form of moth described as *Y. contubernalis*
- 5 Apple twig showing skeletonized and dried leaves and the irregular holes eaten in the fruit
- 6 Pupa natural size
- 7 A parasite, *Diocetes (Limneria) salicicola* Ashm.
- 8 Cocoon of same

PLATE 3

Diagram of experimental orchard, showing location of trees, their size, variety and degree of infestation.

PLATE 4

A very badly infested Howell peartree after it had been treated with undiluted kerosene, two views.

PLATE 5

Shows the harmlessness of 20% kerosene emulsion, both trees are in full bloom.

^a Reproduced through the courtesy of the secretary of the Massachusetts state board of agriculture.

^b Executed from nature, under the author's direction, by L. H. Joutel.

PLATE 6

Views of three trees, one treated with kerosene, one with whale oil soap and the other with crude petroleum. Tree 20 was very badly infested with the scale, tree 110 had very little of the pest and tree 114 is represented as it appeared at the beginning of the experiment.

PLATE 7

Tree 51 shows the comparative harmlessness of 20% kerosene, it is in nearly full bloom. The leaves are starting on tree 93 but they have been retarded by the crude petroleum.

PLATE 8

This plate shows well the difference between crude petroleum and 20% kerosene. The latter is practically harmless and, as the two trees were as nearly alike as possible, the plate illustrates very nicely the injury due to crude petroleum.

PLATE 9

Tree 101 was very badly infested with the scale but otherwise the comparison between 20% and undiluted crude petroleum is a very just one.

PLATE 10

Note the killing of branches which seems to be characteristic of the undiluted crude petroleum such as was used.

PLATE 11

Shows the comparative injury due to December and February applications of the oil.

PLATE 12

Both trees are in good bloom, showing that an application of whale oil soap and petroleum combined does not injure the buds.

PLATE 13

Fumigating tent in operation, the hood was kept extended for the purpose of securing greater constancy in the cubic contents of the tent.

PLATE 14

Peach limb showing injury by fruit tree bark beetle.

PLATE 15

Forest tent-caterpillars on the trunk and larger limbs of an apple tree at East Greenbush.

PLATE 16

The caterpillars on the trunk of the same tree.



1.



2.



3.



4.



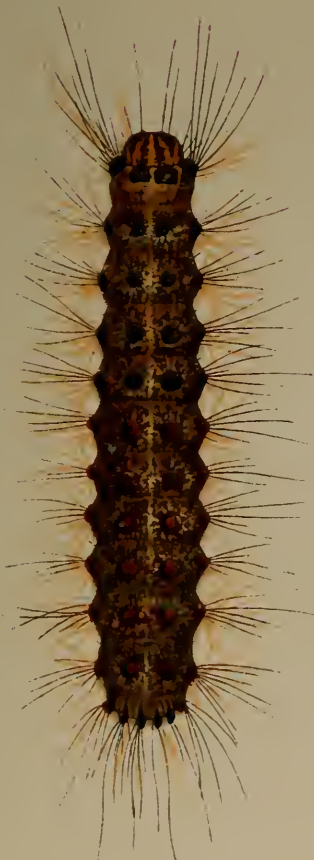
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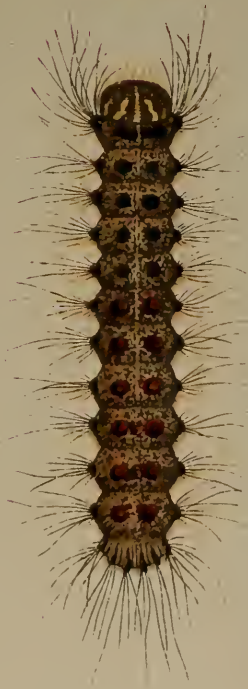
10.



9.



6.



7.



8.

GIPSY MOTH

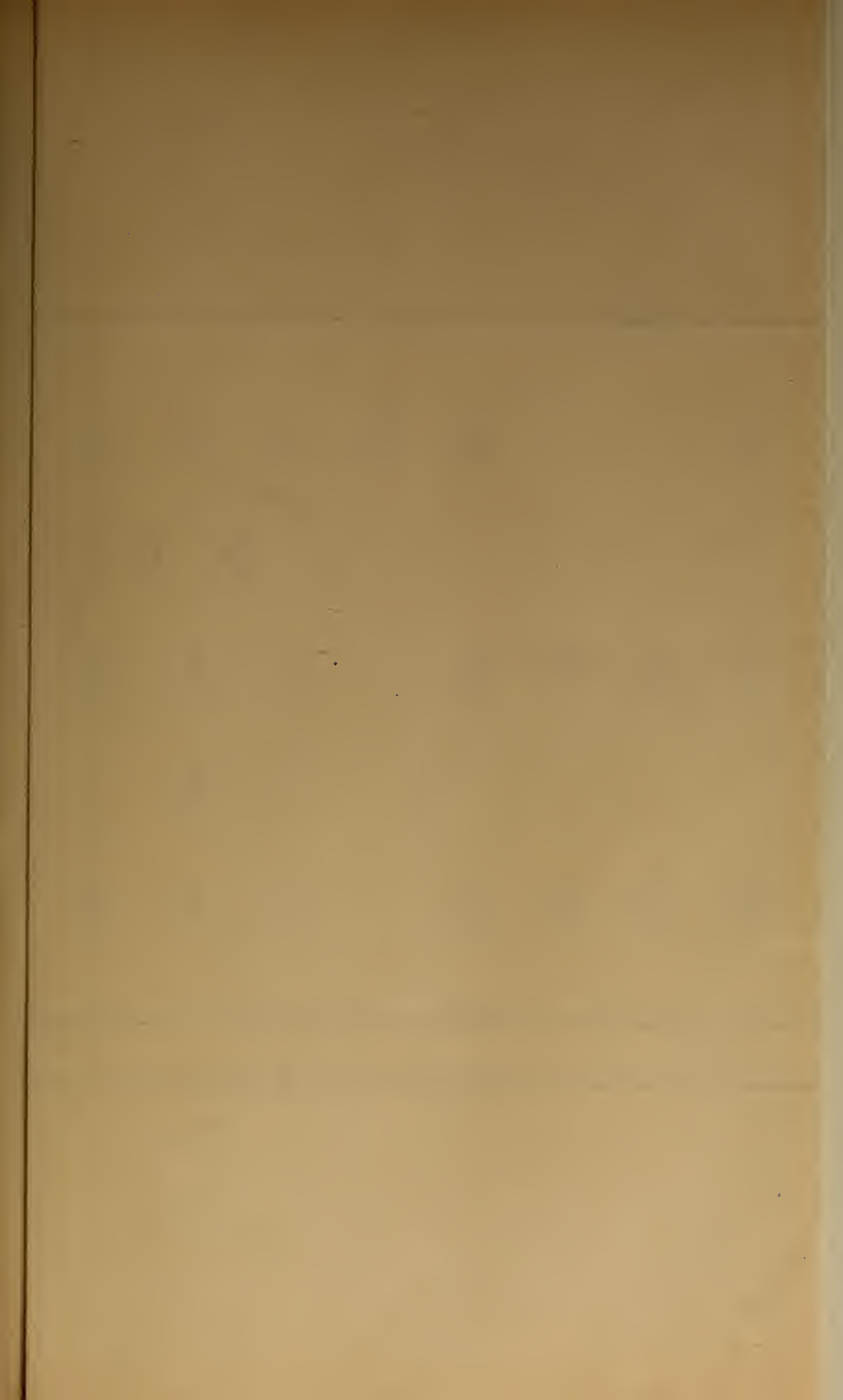
(After Massachusetts state board of agriculture)



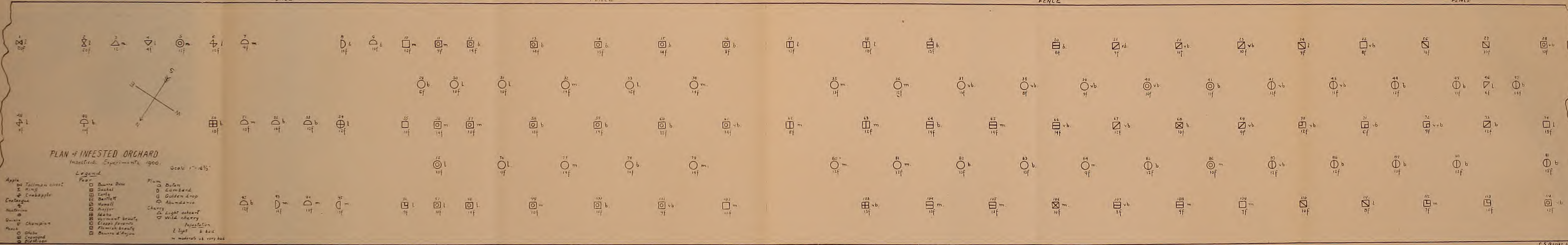
L. H. JOUTEL, 1900

PALMER WORM

JAMES B. LYON, STATE PRINTER.



FENCE FENCE FENCE FENCE



PLAN of INFESTED ORCHARD
 Insecticide Experiments, 1900.
 Scale 1" = 16 2/3'

- Legend**
- | | | |
|-----------------|------------------|-----------------|
| Apple | Pear | Plum |
| □ Tallman sweet | □ Bonne Bois | □ Bula |
| □ King | □ Seckel | □ Lombard |
| □ Crabapple | □ Early | □ Golden drop |
| □ Crabapple | □ Bartlett | □ Abundance |
| □ Nectarine | □ Howell | □ Light orchard |
| □ Nectarine | □ Huff | □ Wild cherry |
| □ Quince | □ Idaho | |
| □ Champion | □ Vermont beauty | |
| □ Peach | □ Elsie's beauty | |
| □ Globe | □ Flemish beauty | |
| □ Crawford | □ Bonne d'Anjou | |
| □ Biddeford | | |
- Infestation**
 □ light □ b bad
 □ m moderate □ vb very bad

ROAD ROAD ROAD ROAD



Tree 21

Howell pear

Photo May 12



Tree 21

Howell pear

Photo July 2

KEROSENE



Tree 3

Light oxheart cherry
20% KEROSENE

Photo May 12



Tree 24

Kieffer pear
25% KEROSENE

Photo May 14



Tree 114 Seckel pear Photo April 19
CRUDE PETROLEUM



Tree 110 Kieffer pear Photo May 14
WHALE OIL SOAP



Tree 20 Bartlett pear Photo May 14
KEROSENE



Tree 51

Botan plum
20% KEROSENE

Photo May 12



Tree 93

Lombard plum
CRUDE PETROLEUM

Photo May 12



Tree 8

Lombard plum
20% KEROSENE

Photo July 2

(Compare the two trees)



Tree 93

Lombard plum
CRUDE PETROLEUM

Photo July 2



Tree 15

Seckel pear

Photo May 14

20% CRUDE PETROLEUM



Tree 101

Seckel pear

Photo May 12

CRUDE PETROLEUM



Tree 101

Seckel pear

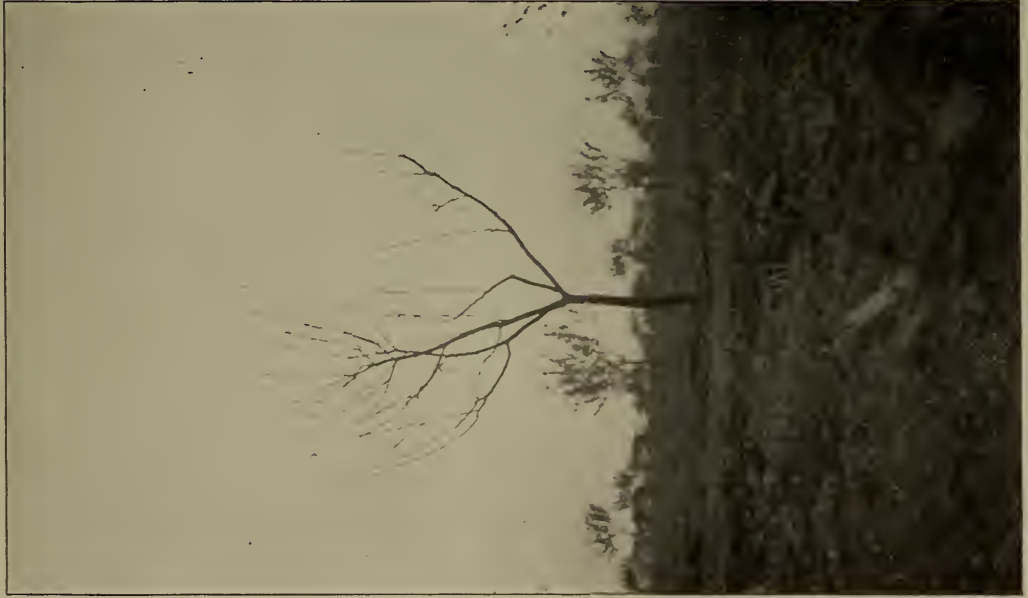
Photo July 2



Tree 114

Seckel pear

Photo July 2



Painted Dec. 1

King apple

Photo May 21



Painted Feb. 14

Sutton beauty

Photo May 21

CRUDE PETROLEUM



Tree 76

Globe peach

Photo May 12



Tree 98

Seckel pear

Photo May 12

WHALE OIL, SOAP AND CRUDE PETROLEUM

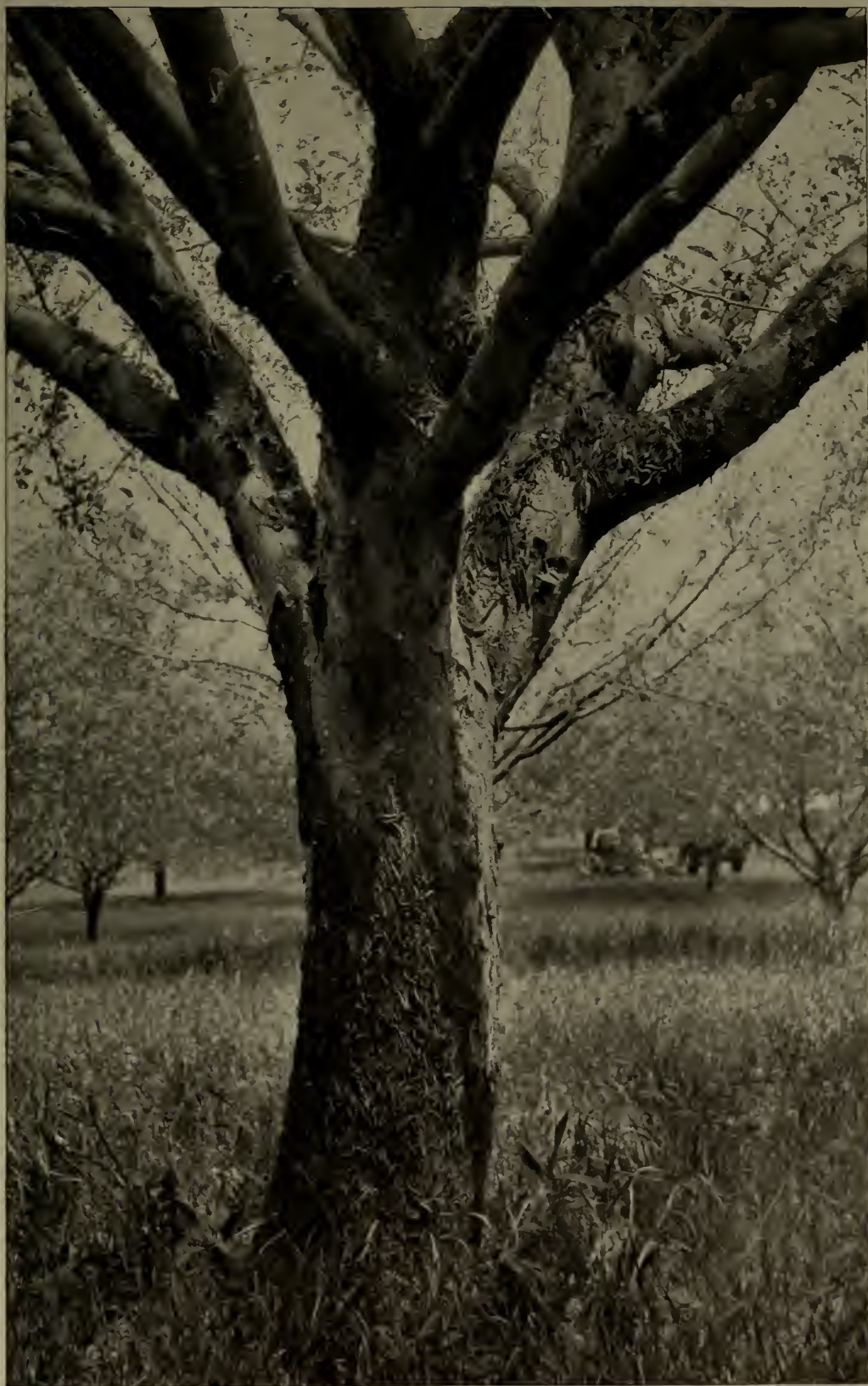


Fumigating tent in operation

Photo April 21



Peach limb showing injury by fruit tree bark beetle



Forest tent-caterpillars on appletree

Photo June 7



Forest tent-caterpillars clustered on tree trunk

Photo June 7



Forest tent-caterpillars clustered on tree trunk

Photo June 7

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ERRATA

- Page 964 line 16 from bottom, for [Limneria] read (Limneria)
 Page 1009 lines 11, 12 from bottom, for *Crepidodera* read *Epitrix*
 Page 1016 line 12, for *Polystochoetes* read *Polystoechotes*
 Page 1017 line 4, for *Phelgethontius* read *Phlegethontius*
 Page 1019 line 2, for *Raphidodemas* read *Rhaphidodemas*



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