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New York State Museum

FREDERICK J. H. MERRILL Director
EPHRAIM PORTER FELT State Entomologist

Bulletin 64

ENTOMOLCGY 17

18th Report of the State Entomologist

ON

INJURIOUS AND OTHER INSECTS

OF THE

STATE OF NEW YORK

1902

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New York State Museum

FREDERICK J. H. MERRILL Director
EPHRAIM PORTER FELT State Entomologist

Bulletin 64

ENTOMOLOGY 17

18th REPORT OF THE STATE ENTOMOLOGIST

1902

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 in the State of New York for the year ending Oct. 15, 1902.

General entomologic features. The season of 1902 was comparatively poor for the development of many insects, and as a consequence relatively few species destructive to staple crops were brought to notice. The elm leaf beetle, Galerucella luteola Müll., has continued its ravages in the Hudson river valley, is gradually extending its range, and is worthy of particular mention because of its having become established in force at Schenectady and Saratoga Springs. The white marked tussock moth, Notolophus leucostigma Abb. & Sm., is a well known pest of city shade trees, and serious depredations by it have been recorded from time to time. Thousands of horse chestnuts in the vicinity of Buffalo were practically defoliated by this insect during the past season, and it is not improbable that the same would have been true of other cities in the western part of the State had it not been for persistent efforts to check the insect in earlier years. The fall webworm, Hyphantria textor Harris, is a common pest which is generally destructive to many trees. It was unusually abundant and injurious in the southern part of the State, particularly in Orange county, and also to a lesser extent in some of the western counties. The black banded Lecanium, Lecanium nigrofasciatum

Perg., is an insect which has attracted comparatively little attention in this State. It was noticed briefly in our preceding report, and during the past summer has become unusually abundant on many soft maples in the city of Albany. The birch leaf Bucculatrix, Bucculatrix canadensisella Chamb., was extremely abundant and injurious over an extended area in 1901, and during the present year has been almost as destructive in portions of the same area. The operations of several bark borers were brought to notice in 1901, and it is gratifying to state that the injuries by these destructive little creatures appear to be lessening. An interesting insect bearing the common name of the carrot rust fly, Psila rosae Linn., was brought to our attention last December on account of its operations in celery at Broadalbin, Fulton co. This is believed to be the first instance of the insect being known to occur in the State.

Office work. It is very gratifying to note that the interest in the work of the office and the demands made on its staff have steadily increased. The determination of scale insects for the commissioner of agriculture, in connection with the nursery inspection work of his department, makes considerable inroads on our time. Most of this delicate and important work has devolved on the first assistant, Mr C. M. Walker. Many photographs of living insects or specimens of their work have been taken during the course of the year, and a number of lantern slides have been added to our collection, which has already been used to excellent advantage in illustrating popular lectures. The mailing list of the office has been largely increased during the past year, principally by paid subscriptions, showing that the public desires our publications and is willing to pay for them when the method of obtaining them is known. The correspondence has nearly doubled over that of the preceding year, as is evidenced by the following figures: 1559 letters, 1811 postals, 1842 circular letters and 2369 packages were sent through the mail during the past year.

The resignation of the first assistant, Miss M. F. Boynton, made a vacancy to which Mr C. M. Walker, then second assistant, was promoted. Mr Douglas B. Young, of Ilion, having successfully passed the civil service examination, was appointed second assistant. These changes in the office force can not be made

without interrupting the continuity of the work and in a measure marring its value. It is to be hoped that in time the salaries for assistants may be large enough to induce men to remain for a series of years.

Special investigations. The lines of work prosecuted in 1900 and 1901 have been continued and other investigations taken up.

The grapevine root worm, Fidia viticida Walsh, had caused so much injury in the Chautauqua grape belt that a special investigation of the pest was undertaken last spring and is still in progress.

The series of experiments with insecticides for the control of the San José scale have been carried on in the same orchard as during the last two years, and the earlier results have been largely confirmed. These have also been tested by experiments in other sections of the State. Further details of this work will be found on subsequent pages. A Chinese ladybug, Chilocorus similis Rossi, has been established in our experimental orchard in the hopes that it will prove a valuable ally in controlling this pest.

The study of forest and shade tree insects has been continued; and the observations of earlier years, together with those of the past season, are now ready for publication, and will appear in an extensive memoir.

The investigations on aquatic insects, commenced in 1900 by Dr J. G. Needham at Saranac Inn, and continued last year at Ithaca, were further prosecuted during the past season. The work of 1902 has been confined largely to a study of the stone flies, Perlidae, and a family of small flies, Chironomidae, a group which is very important so far as fish food is concerned, and which was also reported on to some extent by Mr O. A. Johannsen in Dr Needham's second report.

The entomologist has undertaken an investigation of mosquitos of the State, and considerable information has already been secured. Lack of funds and pressing duties have prevented bringing the work to a successful conclusion.

Publications. The principal publications of the entomologist, to the number of 64, are listed under the usual head. The more important of those issued during the past year are the following: *Scale Insects of Importance and a List of Species in New York*

State (Museum bulletin 46), *Aquatic Insects of the Adirondacks* (Museum bulletin 47), *17th Report of the State Entomologist* (Museum bulletin 53), and the *Elm leaf Beetle in New York State* (Museum bulletin 57). The former two, as stated in our previous report, were practically completed at the end of last year. The bulletin on the elm leaf beetle is an extended and revised edition of Museum bulletin 20, and was issued on account of the great demand for information concerning this serious pest of our elms. In addition to the above, the entomologist contributed an imporant paper on *Aquatic Insects of the Saranac Region* in the sixth annual report of the Forest, Fish and Game Commission, and one on shade tree pests for the report of the Colorado State Board of Horticulture for 1901.

Other important publications which are either in the printer's hands or practically completed are as follows: *Aquatic Insects in New York State,* which is a second report by Dr Needham and his associates, and treats largely of the damsel flies, Odonata-Zygoptera, the insect food of the brook trout, certain aquatic beetles (Donacia), some midges (Chironomidae), a group of much importance as food for fishes, and the Neuropterus family, Sialidae; the bulletin on the grapevine root worm, comprising a detailed account of this very injurious species, with special reference to its control, a publication of 36 pages; a monograph of the genus Saperda, which includes some of our most destructive wood borers, has been prepared by the entomologist in association with Mr L. H. Joutel of New York, and will form a small bulletin of about 40 pages, illustrated by seven colored plates; and the memoir on insects injurious to forest and shade trees, an extensive publication illustrated by many half tone and 16 colored plates, treating specially of those forms which are destructive to shade trees.

Collections of insects. Large additions to the State collections have been made during the past season. The systematic collecting at Karner begun last year was continued throughout the present season, and many interesting forms infesting various forest trees were secured. My second assistant, Mr D. B. Young, spent 10 days collecting at Newport N. Y., where the fauna is exceptionally rich, but, owing to continued unfavorable weather, the results were not all that were expected. Considerable pro-

gress has been made in arranging the Lepidoptera, the work of Mr Walker; while Mr Young has given much attention to the Coleoptera, and this order will soon be in a very satisfactory condition. The collection prepared for exhibition at the Pan-American Exposition has been installed in the museum and is now accessible to the public. A number of additions have been made to it, and desirable specimens are being added as fast as secured. A special collection, illustrating the characteristics of some of our more important mosquitos, has been put on exhibition.

New quarters. The past year is the first entire one in the present quarters; and the additional facilities afforded by them have proved of greatest value and permitted the undertaking of work which would have been impossible under earlier conditions. It was thought at the time the present quarters were assigned that there was ample space, but insects and examples of their work have accumulated so rapidly that a crowded condition is already beginning to prevail.

Voluntary observers. The work of the voluntary observers begun in 1899 has been continued, but, owing to the unusually cold, rainy season, there has been comparatively little to report. The observations made are published under the usual head [*see* p. 144].

Acknowledgments. The entomologist is under deep obligations to a number of professional workers. To Dr L. O. Howard, chief of the division of entomology of the United States Department of Agriculture, and his staff, special acknowledgments are due for the determination of a number of insects and for information supplied. Professor J. H. Comstock of Cornell University has kindly aided in prosecuting the work on aquatic insects during the past summer, and our thanks are due him for these services. It is a pleasure to acknowledge the continued support of the office by its many friends and to feel that our efforts have been so highly appreciated by those in authority.

Respectfully submitted

EPHRAIM PORTER FELT
State Entomologist

Office of the State Entomologist
Albany, Oct. 15, 1902

INJURIOUS INSECTS

Euproctis chrysorrhoea Linn.

BROWN TAIL MOTH

Ord. *Lepidoptera:* Fam. *Bombycidae*

Introduced or foreign insects have played a very important part in earlier years, and, if we may judge from recent developments, this leading role will be continued for some time. Our report for the year 1900 contains a summary notice of one of the most injurious foreign insects which have become established on our shores in recent years; and this occasion is taken advantage of to notice in a similar manner a more recently established species, which promises to be of considerable economic importance as a destroyer of fruit trees and also as a most serious annoyance to man in all localities where it becomes established in numbers. It is not often that an insect is destructive to vegetation and also markedly injurious to man, and yet this is true of the above named species. The hairs of the caterpillar of this species, coming in contact with the human flesh, produce "a fierce and enduring irritation," as characterized by Mr A. H. Kirkland; and so annoying and prevalent was this that the board of health of the city of Boston gave a public hearing on the subject in 1901.

Not in New York. This species does not occur in the State of New York; but, as both the male and female moths are provided with serviceable wings, and as they are readily carried by the winds and with household goods and probably other merchandise, it would not be surprising if the species became established in some locality in New York State in the near future. It was originally located at Somerville Mass., and in 1901 was known to have made its way nearly 30 miles west to Hudson Mass. This species, like some others, is readily controlled when present in small numbers; and, for this reason, we have deemed it advisable to illustrate the insect in color in its various stages, so that it may be readily recognized and promptly checked in any locality where it may obtain a foothold.

Distribution. Messrs Fernald and Kirkland state that the brown tail moth occurs in all parts of Europe, except the extreme north, and also in northwestern Africa and in Asia Minor.

Its presence in this country was first brought to the attention of Prof. C. H. Fernald in 1897, when it was learned that the species had become established in numbers in Cambridge and Somerville. During that year it was found that the pest occurred over the greater part of these two towns and Everett, in a small part of Medford near the Somerville line, and that there was a single colony in Malden. The following year a gale of wind occurred during the height of the flying season, and the moths were carried for a distance of 10 or 12 miles to the north and northeast, as stated by Professor Fernald. The rapidity with which the insect has extended its range is well illustrated by a table of the estimated area infested by the moth in the early years. This was prepared by Mr Kirkland and is as follows:

Area infested fall of	Square miles
1896	29
1897	158
1898	448
1899	928

It will be seen by the above that the insect is rapidly extending its range, and it is now known to occur at Kittery Me. and at Seabrook N. H.

Description. The male moths have a wing spread of about 1¼ inches, are pure white with a satiny luster on the fore wings and have a conspicuous reddish brown tuft at the tip of the abdomen [pl. 1, fig. 5, 6]. Sometimes there are a few black spots on the fore wings. The antennae are white and fringed with pale yellowish hairs.

The females have a wing spread of about 1¾ inches, are the same color as the males, except that they have no black spots on the wings, and the anal tuft is larger and lighter in color, while the antennae are shorter and with shorter fringes.

The eggs are laid in July in masses composed of 200 to 300 and placed usually on the underside of the leaves [pl. 1, fig. 1], where they are covered with brown hairs from the tip of the abdomen. They hatch in a short time, and the young feed during the rest of the season on the surface of the leaves, a few days only being required to skeletonize them. The caterpillars begin to make a nest in which they hibernate while still young. It is constructed on the twigs and is made by drawing together a few

leaves, lining them with silk, and inclosing them with a mass of silken threads. These tents [pl. 1, fig. 7] are so firmly secured to the twigs that they can not be removed without considerable force.

The young caterpillars emerge from their winter retreats before the leaves begin to appear, often attack swelling buds and complete their growth in the early part of June, when they transform to pupae. The full grown caterpillars [pl. 1, fig. 3] range from 1 inch to 1¼ inches in length. The pale brown head is mottled with dark brown and has reddish brown hairs scattered over its surface. The body is dark brown or black with numerous fine, dull orange or gray spots over the surface, which are most pronounced on the second, third and fourth segments. Long reddish brown, finely barbed hairs arise from all the tubercles, and white branching hairs from the upper side of the latter tubercles on segments 4 to 12 inclusive. These white hairs form elongated white spots along each side and are one of the most striking characteristics of this caterpillar. The subdorsal and lateral tubercles on segments 4 to 12 inclusive are covered with fine, short spines of uniform length. There is a bright red retractile tubercle on the top of the 10th, and also one on the 11th segment.

The pupae are ¾ inch in length, dark brown in color and with fine, yellowish brown hairs [pl. 1, fig. 4] scattered over the surface.

Habits of the caterpillars. The following account of the habits of these caterpillars is taken from a bulletin by Fernald and Kirkland, and is as follows:

The young caterpillars of the brown tail moth, after hibernating in the tents which they construct at the tip of the branches, emerge in the spring and feed downward towards the main branches and trunk, leaving the naked twigs bearing the gray tents at the ends, a conspicuous evidence of the presence of this insect. They eat the entire leaf except the midrib, and, in leaves having strong ribs, like those of the sycamore maple, all the larger ribs are left untouched. When the caterpillars are numerous they devour not only the buds, leaves and blossoms, but even the green fruit.

The caterpillars are quite gregarious up to the later stages of their growth, when they disperse to some extent; but when they occur only in moderate numbers, they retain their gregarious

habits to a greater degree than when they are very abundant, since in this case the supply of food is soon exhausted and they are forced to migrate. When these caterpillars molt, they gather in masses on the branches and cover themselves with a scanty mass of silk. When preparing to change to the pupal stage, several of the caterpillars spin up in a common cocoon within the leaves at the tip of the branches. When numerous, they frequently pupate in masses under fences and clapboards, or on the trunks and larger branches of the trees.

The webs of the brown tail moth should not be confounded with those of the tent caterpillar or the fall webworm. They may be distinguished from those of the tent caterpillar by being placed at the tips of the branches, while the tent caterpillar constructs its tent in a fork of the limbs. The latter insect rarely, if ever, attacks pear, which is a favorite food plant of the brown tail moth. The fall webworm, while often found on peartrees, spins a large open web at the ends of the branches and feeds within this web. This insect does not appear until after the brown tail moth has ceased to do damage.

Food plants. This species has been recorded on a considerable number of food plants, but, according to Professor Fernald, pear seems to be the favorite of this insect in the infested region, though winter webs have been found in addition on apple, quince, plum, cherry, peach, oak, maple, elm, rose and grape.

Irritation caused by the hairs. This has been referred to above; and, as there stated, is frequently very severe and annoying. Investigations by Mr F. J. Smith show that the trouble is a mechanical one, and is not, as at first was supposed, due to any poisonous irritant substance in the hairs. The nettling of the skin may be caused by contact with the caterpillars, both old or young, or the cocoons, though in the latter case contact is not necessary since hairs from them are blown about by the winds. Professor Fernald cites the statement of an English journal to the effect that travelers are often affected, when the wind blows strongly from infested hedges along the road.

Natural enemies. A number of parasites have been bred from the pupae in this country. Professor Fernald records the rearing of *Phaeogenes hebe* Cress., *Diglochis omnivora* Walk., *Euphorocera claripennis* Macq. and a large number of unnamed dipterous parasites. He states that the work of Diglochis is specially valuable and worthy of commen-

dation. He also records the destruction of the caterpillars by a soldier bug, Podisus serieventris Uhl.; states that the Baltimore oriole, black-billed cuckoo, crow, bluebird and English sparrow have also been observed feeding on these insects, and quotes Mr Kirkland to the effect that the birds eat not only the moths, but their young, and that it was no uncommon sight at Somerville to see flocks of 20 or more sparrows collect the moths from a picket fence. In addition to the above mentioned birds, Mr E. H. Forbush has recorded the robin, bluejay, black and white warbler, the rose-breasted grosbeak, the chestnut-sided warbler, the scarlet tanager, redstart, chickadees, red-eyed vireos, the yellow-throated vireo and the male indigo bird as feeding on the caterpillars. The records given by Mr Forbush include the number of larvae eaten by each bird and the time occupied. None ate less than nine, and one as many as 57 caterpillars, the latter operation occupying 20 minutes. These observations show that our native birds will undoubtedly prove to be very efficient aids in checking this pest. Professor Fernald has also recorded bats as feeding on the moths at night, and he states that toads devour the caterpillars during the early summer and the moths later in the season.

Remedial measures. The conspicuous hibernating nests [pl. 1, fig. 7] of this species are easily detected at any time when the foliage is off the trees, and one of the most effective methods of checking this pest is to cut them off and burn them. This can be very easily done with the aid of long handled pruning shears. The insect is also readily controlled with arsenical poisons; and Professor Fernald reports experiments in spraying with arsenate of lead, in which 1 pound to 150 gallons, killed 50% of the caterpillars in four days, 90% in seven days and all in 13 days. Treatment with the same insecticide, 2 pounds to 150 gallons, gave similar results, and, when 5 pounds were used to 150 gallons, 80% were dead within four days and all in nine days. The use of 10 pounds to 150 gallons resulted in the destruction of all the caterpillars in six days.

Spraying with paris green, 1 pound to 150 gallons, killed 4% in four days, 70% in six days and 90% in nine days, all being dead in 12 days.

BIBLIOGRAPHY

1897 **Fernald, C. H. & Kirkland, A. H.** Mass. Agric College Sp. bulletin, July. p 1–15. (Summary account of the introduction and occurrence of the insect)

1897 **Harvey, F L.** Maine Agric. Exp. Rep't, p. 175. (At South Berwick Me.)

1898 **Fernald, C. H.** U. S. Dep't Agric. div. ent. Bul. 17. n. s p. 24–32. (Brief description of the insect and means of controlling it)

1899 —— Mass. Hatch Exp. Sta. Rep't. p. 101–2. (Distribution, work against)

1899 **Forbush. E. H.** U. S. Dep't Agric. div. ent. Bul. 20, n. s. p. 88–89) (Birds feeding on larvae); Mass. State Board Agric. Rep't, p.319–20, 322. (Birds feeding on)

1899 **Harvey, F. L.** Maine State Bul. 61. p.36–42. (Occurrence in Maine and general account)

1899 **Wood E. W.** *et al.* Mass. State Board Agric. Rep't, p.384–85. (Summary of work, distribution)

1900 **Kirkland, A. H.** U. S. Dep't Agric. div. ent. Bul. 26. n. s. p.75–76. (Spread of the insect)

1901 **Davis, C. E.** 30th An. Rep't of Health Dep't City of Boston. Abstract, p.195–96. (Brief abstract of Fernald and Kirkland's bulletin)

1902 **Kirkland, A. H.** U. S. Dep't Agric div. ent. Bul. 31. n. s. p.95. (Irritation by hairs and spread); Mass. Hortic. Soc. Trans. 1902. p.12-21. (Summary account)

Psila rosae Fabr.

CARROT RUST FLY

Ord. *Diptera:* Fam. *Psilidae*

Celery roots infested with a dipterous larva, which subsequently proved to be this species, were received Dec. 30, 1901, from James Granger, Broadalbin, who states that the attack was confined to the roots and crown, never interfering with the stalk. Several larvae were taken from one root, and their burrows, about $\frac{1}{16}$ inch in diameter, were lined with reddish particles of comminuted tissue. The galleries were found in the roots near the crown and also in the crown and frequently ran obliquely for a distance partly around the root or crown, as the case may be, and in some instances they were near the center of the infested plant. The attack was a serious one, as is evidenced by the ruining of about 6000 plants. Traces of the insect were found all over a field containing some 60,000 plants.

Introduction and injuries in America. This is a European insect, which prior to 1885 was not known to occur in this country. It was then reared by Dr Fletcher from carrots purchased in the market at Ottawa, where the following year he found young carrot plants in a garden badly attacked. The same year a great deal of damage was done, particularly to stored roots

during the winter. Mr F. B. Caulfield, an entomologist in Montreal, reported that in February 1887 nearly all the carrots he had seen exposed for sale were more or less attacked. Early carrots were badly injured at Nepean Ont., nearly every root showing signs of the insect's presence, and two thirds of the crop was seriously injured, as stated by Dr Fletcher in his report for 1887. The species was reported in 1897 as occasioning considerable complaint during the previous 10 or 12 years, chiefly in the province of New Brunswick, but also in Ontario and Quebec. The attack was described as being a serious one, rendering useless roots stored for table use. A party at Rothsay, Kings co. N. B. noticed in 1895 that late sown carrots were less injured than those planted earlier, and since that time late sowing has been recommended and proved of considerable value, according to Dr Fletcher's report for 1897. Injury has also been recorded at Upper Sackville, Brookville and Clifton N. B., it being noticed in the first named locality in 1894 and 1895 and at Brookville during the latter year and at Clifton for several years. Few carrots had been grown in the last named locality during late years, on account of this pest, as stated by Dr Fletcher in his report for 1897. The following year he records specific injury to carrots at Noulton and Ste Marie Que.

The above summary of the insect's occurrence in this country, as well as some of the following matter, has been taken from Mr F. H. Chittenden's account in Bulletin 33, new series, of the division of entomology of United States Department of Agriculture.

Distribution. This species is a well known pest in England and Germany and probably occurs elsewhere on the continent of Europe. It was originally described from Kilia, Bessarabia. Just when it was first introduced in this country does not appear to have been recorded. Its ravages were not apparent however till 1894, and up to last year the insect appears to have been confined to Canada, though there is in the National Museum a single specimen received from Mrs A. T. Slosson, labeled Franconia N. H. There appears to be no record other than Mr Chittenden's, which relates to the same outbreak, of the species having been found previously in New York State, and celery is a new food plant for the pest. This divergence in food habits is not sur-

prising, since it frequently happens that a species introduced into a new country forms new habits and depredates on other plants. Mr Chittenden expresses the opinion that the insect has probably been established in Canada for at least 18 years and adds that it will probably not extend farther south than the upper Austral life zone.

Life history. The life history of this species does not appear to have been worked out. The insect undoubtedly passes the winter in puparia and, according to Mr Chittenden, possibly as larvae. Since the larvae work on stored roots, the flies may develop in winter, as occurred at Washington and also in our own breeding cages. This permits great irregularity in development and makes it impossible to accurately forecast the habits of the insect in the field. The flies probably develop rather early in the season and attack young carrots, which turn a rusty red color. An examination will show that the roots have been disfigured with rusty patches, specially toward the tip. Both the flies and maggots are found throughout the warmer months, but the latter desert the roots and pupate in the earth. It is very probable that the last generation in a season descends much deeper than the earlier ones. The life cycle is completed in three or four weeks, as stated by Curtis, and no one appears to have determined the number of generations which may be produced. Mr Chittenden is of the opinion that there are at least two and probably more, and we are inclined to think his estimate is a conservative one. Miss Ormerod states that the fly goes into the ground for oviposition wherever it can find a crack or other opening about the roots, and that the maggots, after hatching, work their way into the roots and even when quite small destroy the entire lower portion.

Description. The adult or parent fly is quite minute, measuring only about $\frac{1}{6}$ inch in length and with a wing expanse of little more than $\frac{3}{10}$ inch. The color is dark green, by some authors given as black, and the insect is rather sparsely clothed with yellow hairs. The head and legs are pale yellow and the eyes black.

The maggot or larva is pale yellowish white when half grown and when full grown presents a general resemblance to that of the cheese maggot, to which the species is somewhat closely related.

It is then much darker in color, being rather dark brown with well marked segments, a minute head and the posterior extremity truncate. The general appearance of the larva is shown at figure 1.

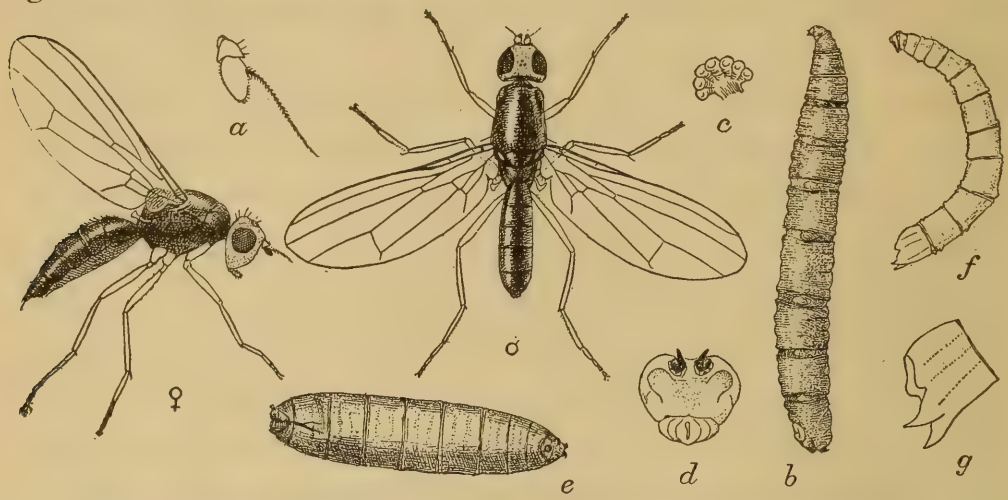

FIG. 1 Psila rosae: ♂ male fly, ♀ female fly: lateral view; *a*, antenna of male; *b*, full grown larva, lateral view; *c*, spiracles of same; *d*, anal extremity from the end; *e*, puparium; *f*, young larva; *g*, anal segment from side — flies, young and mature larva, and puparium, eight times natural size; other portions more enlarged. (After Chittenden, U. S. Dep't Agric. div. ent. Bul. 33, n. s. 1902)

Natural enemies. Very little has been recorded concerning the natural enemies of this species. Curtis found a small four winged fly which he described as Alysia apii and presumed was a natural enemy of this pest.

Remedial measures. This species, like others which exist under ground, is difficult to control with insecticides, and our principal dependence must therefore be based on cultural methods which may serve to avert attack.

The standard kerosene emulsion, 1 part to 10 of water, may be sprayed along carrot rows with knapsack or other sprayer. Sand, land plaster or ashes, with which kerosene has been mixed at the rate of ½ pint to 3 gallons, may be sprinkled along the rows. These, with the exception of crude carbolic acid, a pint in 5 gallons, are about the only substances which have given good results. Dr Fletcher states that in Canada one or the other of these applications should be made weekly during June from the time the roots begin to form, and particularly after the rows have been thinned.

Late sowing has also been practised to great advantage, and a number of persons have found it to be of considerable value.

Rotation of crops. This may be practised with comparatively little expense, and is very successful in checking pests of this character. The fields planted in successive years should be as far from others as practicable. Some of the most serious injuries have occurred on pieces where carrots have been grown year after year. Now that we know this insect breeds in celery as well as carrots, one should not follow the other. Clean cultivation should also be practised in order to destroy all remnants of either celery or carrots in which the insects may pass the winter.

Destruction of the insect in stored roots. The breeding of this species in stored roots suggests the advisability of destroying the larvae which forsake the roots and enter the soil to undergo their transformations, or the puparia. Where roots are packed in earth, the surrounding soil may be either buried deeply or spread out in thin layers where it will be exposed to the elements, or thrown into pools where it may be frozen, or exposed to heat or steam or any agency which will result in the destruction of the contained insects. These roots are also frequently stored in bins in cellars; and such inclosures, if nothing else be done, should have all openings protected by a fine wire screen, so that the adult insects can not escape to the open the following spring. It might be possible to fumigate such a cellar with carbon bisulfid or sulfur or hydrocyanic gas before opening it in the spring.

Fall cultivation. Mr Chittenden has recommended the light raking or cultivating of celery or carrot beds in the fall, so that the larvae or puparia may be destroyed by the frost. He also thinks that plowing early the following spring before the flies have had time to escape would result in destroying many of the insects.

NOTES FOR THE YEAR

The following brief account includes some of the more important insects brought to notice during 1902.

Special attention, as in the case of last year, has been given to forest and shade tree insects throughout the summer. Systematic collecting was continued at Karner, where there is an admirable growth of scrub oaks and small pines, and much valuable material secured, which will be reported on in another publication. The warm, sandy soil of Karner seems specially adapted for certain heat-loving insects; and last year we

were surprised at finding the large cicada-killer, Sphecius speciosus Drury, comparatively abundant.

Another southern species, Polyphylla variolosa Hentz, was found at Karner Aug. 4, 1902, by Mr Young. The specimen was dead, but in a good state of preservation, and was evidently native. This southern species has not, to our knowledge, been taken so far north in this state at least.

Another interesting capture was that of Cincindela punctulata Fabr, which was taken at Albany Aug. 4, 1902, by Mr Young.

The notes regarding the various species mentioned below have been grouped under convenient heads, as last year, so they may be of greater service to parties interested in the more practical aspect of this work.

Fruit tree pests

Appletree tent caterpillar, Clisiocampa americana Fabr. This species is annually more or less destructive in various sections of the State, and the season of 1902 has proved no exception to the general rule. Accounts of some severe injuries have been received from certain counties, and in others relatively little damage has been inflicted. Something out of the ordinary and worthy of record is reported by Mr J. F. Rose, of South Byron, who states that this common pest was extremely rare in Genesee county, and attributes the scarcity to the large number of wayside bushes killed by mice, which girdled them while protected by the heavy snows of last winter. The injury by mice was so extensive that almost every bush for considerable distances along the highway was killed in this manner; and the young caterpillars hatching from eggs on these bushes perished from lack of food.

Forest tent caterpillar, Clisiocampa disstria Hübn. The severe injuries to forest trees by this pest during the past four or five years have been gradually decreasing, and areas where the insect has been extremely destructive in earlier seasons have suffered comparatively little. The zone of greatest damage is apparently moving eastward in the case of Greene county. Some damage was inflicted on maple and orchard trees in eastern Greene and western Columbia counties during the past season, but the depredations generally speaking were not nearly so

severe as last year. The hard maples at Annandale, Dutchess co., suffered to some extent from the work of this pest; and, while the species was reported as being rare at Newport, Herkimer co., it was extremely abundant at Gravesville, only 7 miles north. A little damage by this insect was reported from Tompkins county. This record is somewhat different from that of last year and decidedly so from the one for 1900.

Bud moth, Tmetocera ocellana Schiff. This little insect appears to be on the increase in Genesee county according to the statements of Mr J. F. Rose, of South Byron, who considers it one of the worst pests of the orchard in that section of the country. The most dangerous feature in connection with this insect is the occurrence of the hungry, voracious, partly grown larvae on trees when the young foliage is developing, and when a small amount of feeding will produce a relatively large amount of damage. It can be controlled, as has been repeatedly demonstrated, by thorough spraying with an arsenical poison just as the buds are unfolding.

Apple leaf Bucculatrix, Bucculatrix pomifoliella Clem. This is a well known enemy of the apple in the western part of the State at least and is occasionally exceedingly abundant. Mr L. L. Woodford, of Berwyn N. Y., has recently called our attention to 150 trees which were very badly infested with this insect. Examples of the twigs accompanying his communication were nearly covered in places with the characteristic white or yellowish cocoons. The general appearance of the insect is represented in the accompanying figure. It may be controlled by thorough spraying in early June with an arsenical poison.

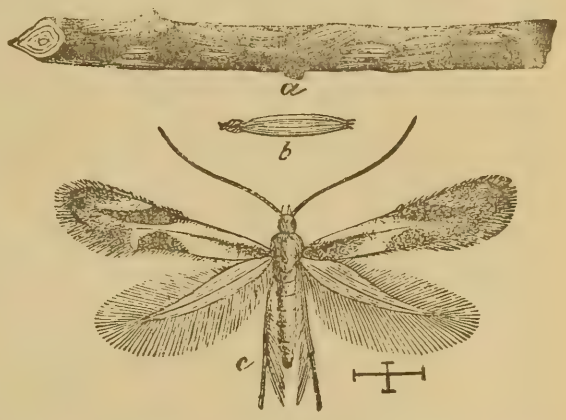

FIG. 2 Apple leaf Bucculatrix, Bucculatrix pomifoliella; *a*, piece of twig covered with cocoons; *b*, cocoon enlarged; *c*, the moth, enlarged

Small fruit insects

Raspberry cane maggot, Phorbia rubivora Coq. This species has been noticed from time to time on account of its

injuries to blackberry and to raspberry canes, and last May our attention was called to damage, probably the work of this insect, by Mr J. S. Kimberly, of Hamilton N. Y., who states that the maggots were quite destructive to blackberry and raspberry fields in that locality.

The parent insect is a small fly, and the most practical method of checking this species is by cutting the wilted tips well below the point of injury as soon as they appear and burning them.

The raspberry cane-girdler is a small beetle known as Oberea bimaculata Oliv., and works in a similar manner. It may be distinguished from the preceding by the fact that it does not begin its burrows till in June, and that the wilting is caused by series of punctures forming two rings around the cane from ½ to 1 inch apart, which the small beetle makes with its mandibles, and between which the egg is deposited. The latter insect may be controlled in the same manner as the preceding.

Grass and grain insects

Clover mite, Bryobia pratensis Garm. This little mite is a very common species and occasionally is present in immense numbers toward the end of the season, at which time it may cause serious injury by sucking the vital fluids from the leaves.

Mr L. L. Woodford, of Berwyn, has recently called our attention to what, for this State, is an abnormal abundance of the eggs. He states that one peachtree was so badly infested that many square inches of its surface presented a red color on account of the abundant eggs. In some places areas the size of a silver dollar appeared as if splashed with red paint. A twig, submitted with his communication, showed myriads of the characteristic eggs around every bud and at the base of each branch. They were so numerous as to give a distinct red coloring to an irregular area around each prominence. Dr C. L. Marlatt has recorded instances where the eggs were much more numerous on trees in the western states, but, so far as known to us, this species is not usually so abundant in the East. The eggs may be destroyed, as shown by experiments of Prof. C. P. Gillette, by spraying in winter with the standard kerosene emulsion diluted with but 5 parts of water. It is very probable that the 10% or 15% mechanical

crude petroleum emulsion would be just as effective and on some accounts preferable.

Corn worm or bollworm, Heliothis armiger Hübn. This southern species is well known on account of its serious depredations on cotton, and occasionally it is brought to notice in the northern states because of injuries to corn or tomatoes.

Dr M. W. Van Denburg, of Mount Vernon N. Y., reports this species as being unusually abundant in that section, where it occurred on sweet corn during the latter part of August. He states that the larvae eat the succulent husks, the kernels and also the juicy cob, leaving their burrows full of a brownish, moist excrement, in which they seem to be packed. He adds that the larvae occurred in about 10% of the ears.

Hessian fly, Cecidomyia destructor Say. The serious depredations of this grain pest were recorded in a preceding report; and the statement that practically no harm has been inflicted during the past season, not even in cases where white or no. 6 wheat was so seriously damaged the preceding year, is worthy of record.

Pea weevil, Bruchus pisi Linn. This little insect is a species which occurs somewhat commonly in peas, and its presence is too frequently overlooked or regarded as of comparatively little importance, and those planting a few peas or even growing them on a considerable scale, pay little or no attention to whether the seed is infested by this insect or not. As a matter of fact, this subject is one of considerable importance, particularly in Canada, where the species has caused enormous losses in recent years, and, unless repressive measures are adopted or enforced, it may cause much damage in the United States. Aside from direct injury, it is a well established fact that peas infested by this species have not the commercial value of clean seed, since, as determined by Dr Fletcher, only 17% to 20% of the infested ones will germinate. This means that where the weevil is at all abundant in the seed, one half to four fifths of it may be worthless; and purchasers will do well to bear this in mind. The sowing of this seed not only results in a less than normal number of plants, but also aids the propagation of the insect; and it is very probable that a great many of these pests are eaten in green peas — something which is not agreeable to contemplate.

The species can be easily controlled, since it is confined to one food plant, namely peas, and hibernates either within the seed or in sheltered places.

If the peas for seed purposes are harvested early, promptly threshed and treated with carbon bisulfid, none of the insects will be able to survive; and Dr Fletcher states that if the peas be tightly inclosed in a paper bag, the weevils will be unable to escape from their prison, and, if the seed be held over till the second year, which may be done without injuring its germinating powers, all of the weevils will die, and consequently there will be no danger of the species propagating. This simple method involves little or no additional expense; and, if the large growers of seed peas will in turn cooperate and fumigate all of their stock, there should be comparatively little or no trouble from the species in future years. It would undoubtedly be good business policy for growers of peas to print on each package a statement that the seed has been properly fumigated; and buyers are urged to insist on this treatment or to apply it to seed before it is planted.

Shade tree insects

Elm leaf beetle, Galerucella luteola Müll. This serious enemy of elms in the Hudson river valley has inflicted considerable injury during the past season, though it does not appear to have been quite so abundant in Albany and vicinity as in earlier years. It has also been reported as present in reduced numbers at Annandale, Dutchess co. It still ranks however as a pest of prime importance, and, where repressive measures, such as spraying with an arsenical poison, are not employed, many trees have sustained very serious injuries. The insect is gradually extending its range in the upper Hudson and lower Mohawk valleys, as is evidenced by its being widely distributed and quite injurious at Schenectady and also by its location recently in large numbers at Saratoga Springs. The latter outbreak is of considerable interest, because it is the most northern locality where very serious injuries have been caused by this species. It was hoped a few years ago that climatic conditions in this and similar localities would prevent serious depredations. This opinion has been refuted by its work in 1902; and it now remains to be seen whether the insect will prove to be seriously destructive for a

term of years. A recent note[1] by Prof. M. V. Slingerland states that this species occurs in small numbers at Ithaca N. Y.

White marked tussock moth, *Notolophus leucostigma* Abb. & Sm. This is one of the well known serious enemies of our shade trees in some of the larger cities of the State; and it is not unusual to see a number of horse-chestnut trees defoliated by the caterpillars. The cities of Albany and Troy have been comparatively free from this species in recent years, because in all probability, of the active measures employed for the control of the elm leaf beetle, which naturally resulted in other insects receiving the same treatment when their unusual abundance rendered it necessary. The work of this insect was exceedingly prevalent during the past season in the city of Buffalo, where it defoliated thousands of horse-chestnut trees over a considerable portion of the city. It was an exception to find one which had escaped injury, and the foliage of practically all of the trees was destroyed.

This species occasionally produces two generations a year in the vicinity of Albany, a fact which has not been previously recorded. The writer's attention was drawn to a number of the caterpillars of this insect on a small, soft mapletree in Albany in the early part of September. These were undoubtedly a second generation, and occasionally individuals of the same species have been met with here and there during the latter part of the summer. This is very interesting, since this species is known to produce two generations normally in Boston and New York, while at Albany and probably some distance south a single brood is the rule.

Fall webworm, *Hyphantria textor* Harris. This is one of the injurious general feeders, which is usually present each year in greater or less numbers in some section of the State. It was unusually abundant and destructive in the southern counties, particularly in Orange and Rockland, where its nests were very conspicuous in many trees. It was also reported as quite abundant and destructive in some of the western counties, specially in Genesee, where it was stated to be more numerous than Mr J. F. Rose had even seen before. This species is such a general

[1]Entomological News, Jan. 1903, 14:30.

feeder that under ordinary conditions it does not inflict serious damages, and is usually fairly well controlled by natural enemies.

Black banded Lecanium, Lecanium nigrofasciatum Perg. This small insect has previously attracted comparatively little attention in this State. It was noticed briefly in our previous report and was brought to the attention of Dr Lintner in 1896, by examples sent from Poughkeepsie, where it had been exceedingly abundant on a hard maple. It has been observed in relatively small numbers on soft maples in Albany till the last few years, when it has become plenty on certain trees, and during 1902 it was found to be present in immense numbers on many soft maples. The insects were so abundant that a large amount of honeydew was excreted, and the growth of the trees seriously checked by its work.

Forest insects

Willow and poplar curculio, Cryptorhynchus lapathi Linn. This destructive weevil has been quite injurious to nursery stock in western New York during the past season. Its presence is usually indicated externally, in the case of willows, by a purplish discoloration of the bark on either side of the transverse burrow and by the drying and shrinking of the thin bark directly over the gallery.

The full grown larva or grub burrows in the center of small stems, frequently for a distance of 3 or 4 inches, and the pupal cell is found near the extremity of this burrow [pl. 6, fig. 1]. The galleries of the young grubs occur around buds and at the base of small limbs and frequently partly girdle the tree. Their presence is not so conspicuous as the work of older individuals and is usually indicated by a brownish discoloration with a few minute borings near the entrance.

Larvae, pupae and adults were found in infested stock submitted for examination July 18. A number of adults were bred in the course of a few weeks. The insect was so abundant in some nurseries as to cause serious loss and, on account of its working within the stems, is a difficult one to control. The destruction by fire of badly infested trees appears to be the most practical method of checking it, though something may possibly be accomplished by spraying the stems of young willows and pop-

lars with a repellent insecticide, such as whale oil soap or the carbolic soap wash. These applications should be made about the first of July and probably repeated toward the latter end of the month, the time for second treatment depending somewhat on the amount of rain.

Nun moth, Psilura monacha Linn. Our attention has recently been called to the reported presence of this European insect at Brooklyn N. Y. According to the published account,[1] Mr George Franck stated that, on looking over the small collection of a local collector during the summer of 1901, he found among other material five individuals of this species, which he identified by comparison with European specimens, of which he possessed a number. The collector in question had no communication with others than Mr Franck, from whom he obtained material in exchange, and, when he was questioned regarding this species and its occurrence, Mr Franck was assured that the specimens had been captured at light in Brooklyn. No other person who had been consulted in regard to this species knew anything of its occurrence in that vicinity, and it was put down as an accidental importation, which is possibly true. The person who made the capture resides in a district where there are numerous lumber yards, and shipping is quite extensive. The location is described as being around North 2d street and Metropolitan avenue, near a creek which adjoins that portion of the bay running through the eastern part of Brooklyn. Since only five of the insects were taken, it may not be that the species has been introduced; but, as pointed out by Dr Howard, we may have here a parallel case to that of the gipsy moth, Porthetria dispar Linn., which was known to be actually introduced into this country 25 years before it attracted the attention of economic entomologists. The two species are related and have similar habits; and there is reason to believe that, if this species does become permanently established in the vicinity of New York, it will prove a serious enemy and perhaps be even more troublesome than the gipsy moth. The latter was established inland, while the nun moth, if it has obtained a foothold, will probably spread to the immediate vicinity of water ways on either side. This feature

1 Howard, L. O. U. S. Dep't Agric. div. ent. Bul. 38. n. s. 1902. p.90-91.

alone makes the matter of much greater importance, since vessels would afford the insect excellent opportunities to extend its range in this country, and there would be much greater difficulty, if it should become at all abundant, in limiting the spread of the species than was the case with the gipsy moth.

The parent insects are said to fly during July and August. The moths are a grayish or yellowish white, irregularly marked on the fore wings with dark brown or black, as shown on plate 6, figure 2. The hind wings are a pearly gray and margined with grayish brown spots. The abdomen is transversely marked with more or less distinct black bands interspersed with a reddish or rosy hue. The female has a wing spread of nearly 2 inches and the male about an inch and a half. The latter may be recognized by its smaller size and the pectinate antennae.

The larva has been described by Furneaux as follows: "The caterpillar is hairy, and of a grayish white color. A brown stripe runs down the back. On the top of the second segment are two blue tubercles; and there is also a tubercle, of a reddish color, on each of the ninth, 10th and 11th segments."

The larva has been recorded as feeding on a number of trees, notably oak, birch, fir, pine and apple, becomes full grown in June or July, and is specially injurious to spruce forests.

This species, as recorded by Myrick, is sometimes exceedingly destructive to fir forests on the continent, stripping the trees so completely as to kill them. A more detailed account of what this insect will do is given by Professor Fernow, now director of the New York State College of Forestry. He states[1] that the ravages of this insect in Europe from 1853 to 1867 involved an area of over 100,000 square miles and destroyed 55,000,000 cords of wood, necessitating the premature cutting of 7,000,000 cords to save it from subsequent attack by bark beetles. The attack in 1891 at first involved some 20,000 acres of spruce in upper Bavaria, but soon reports were received from all parts of Germany, Austria, Bohemia, etc., indicating an unusual abundance of the insect, so that many thousand square miles of forest were involved. Over $8000 were spent in the first named district in checking the ravages of the insect, and a special committee was

[1] Insect Life. 1891. 3: 379.

appointed by the Bavarian government to discuss and advise measures to prevent the further spread of this species. The situation was so grave that the German government in 1891 appropriated $350,000 to fight this pest, most of which was expended on banding with an insect lime.

Walnut worm, Datana integerrima Gr. & Rob. This is our most common species belonging to the genus and one which is annually present in greater or less numbers in the western part of the State. It defoliated many butternut and walnut trees in Genesee county during last summer, as reported by Mr J. F. Rose, of South Byron; and our observations showed that it was also extremely abundant in Chautauqua county, where a considerable number of trees suffered severely from its ravages. Some of the smaller and worse infested trees lost most of their foliage, while the larger ones suffered to a less extent.

Birch leaf Bucculatrix, Bucculatrix canadensisella Chamb. The extensive depredations of this insect [pl. 6, fig. 3] in 1901 were noticed in a previous report. The species has not been quite so abundant during the past season, though in the vicinity of Karner a large proportion of the birches were practically skeletonized. State botanist Peck has also informed the writer that it was exceedingly injurious in the vicinity of Lake Placid. The work of the pest was so general in that section that clumps of birches could be recognized at a distance by their uniform brown color.

17 year cicada, Cicada septendecim Linn. The brood of this insect, due to appear in New York State the present year, was a very limited one; and the following localities, kindly communicated to me by Mr Chester Young, of Ellenville, are placed on record. The insects were observed by him at Wantagh, Nassau co.; also between Massapequa and Amityville, between Sayville and Oakdale, east of Patchogue to Brookhaven, and also to the north of Medford and Holtsville, and a small brood northeast of Riverhead, all in Suffolk county.

The writer has been unable to verify the occurrence of the insect in either Monroe or Niagara counties, where it had been reported in earlier years.

Household insects

Webbing or southern clothes moth, Tineola biselliella Hummel. This species is a southern form, which is stated by

Messrs Howard and Marlatt to be the more common one in the latitude of Washington. It also occurs farther north; and the breeding of it in considerable numbers from insects which had been in our collection for some years is worthy of record, though it is not a new habit, since the larva is known to feed on a variety of animal substances and has been previously recorded as occurring in collections. It was abundant enough in our own, so that one large moth was nearly destroyed, and a number of others injured, and it is apparently a form which would cause considerable damage if allowed to breed undisturbed.

Beneficial insects

Twice-stabbed Chinese ladybug, Chilochorus similis Rossi. The establishment of Aspidiotus perniciosus Comst. at San José Cal., and its subsequent spread to and injuries in many of the eastern states have led to active seeking for means of controlling this pest. Countless experiments with various insecticides have been carried out, and considerable attention has been given to ascertaining the original home of this species, in hopes that some natural enemy might be found there which would prove of great service in checking it. The personal investigations of Dr C. L. Marlatt in Japan and China in 1901 led this gentleman to conclude that the original home of this species was in northern China, and its most effective natural enemy in that section was the above named ladybug, and he shipped living examples of this species to Washington D. C., where they were carefully reared for the purpose of ascertaining their value. We were fortunate enough to obtain 50 adult beetles last August, and have since kept them on a badly infested tree inclosed in a tight, wire-covered breeding cage. The insects were placed on the tree Aug. 13, and a number of them were observed investigating young scales very shortly after being liberated. Examination Aug. 22 showed that the beetles were apparently healthy, though there were no signs of eggs or grubs, and some of the scale insects appeared to have been eaten. Early the next month one beetle was found, but no evidence of breeding was observed. Sep. 23 an examination by Mr Young resulted in finding about 150 larvae or grubs, which were working almost entirely on the southern side of the tree. There were more of the insects on twigs than on

leaves, and fewer scales were observed on the portion of the tree where the predaceous larvae were most abundant, since the scale insects were not clustered along the midribs of the leaves where the grubs occurred, as was the case in portions which appeared to be free from them. Oct. 17 the cage was again visited, and a few living larvae or grubs, together with two or three living beetles and a considerable number of pupae, were found. Five or six pupae were observed on the wire side of the cage, and there was considerable evidence of the larvae having eaten large numbers of the scale insects.

This species resembles our native twice-stabbed ladybug, Chilocorus bivulnerus Muls., so closely that only a specialist can separate the adults. There is more difference between the larvae of the two species, the skin of the imported form being reddish or a flesh tint, while that of our native species is dull gray. The larval spines of the introduced species are less prominent and differ structurally from those of our native ladybug. There appears to be no reason why our native species should not be equally valuable in checking this scale insect, but at present at least this introduced form seems to be much more effective, and it may prove to be an exceedingly valuable ally in combating this most pernicious scale insect.

Praying mantis, Mantis religiosus Linn. The distribution of the eggs of this beneficial species in a number of localities in the Hudson and Mohawk river valleys was recorded in our preceding report, and the statements of some of the recipients that eggs hatched and individuals developed were also published. It is worthy of record that the eggs of this species were reported by George S. Graves, Newport, as hatching June 22 of the present year, and Mr W. C. Hitchcock, Pittstown, states that a nearly full grown individual was taken by him Sep. 8, and that several others were observed by neighbors. There is a bare possibility of a mistake in some of the above records; and yet the appearance of this insect is characteristic, and, as each of these gentlemen were supplied with figures of the insect, it hardly seems as if there could be any doubt of the insect having become established in these two localities.

Chinese praying mantis, Tenodera sinensis Saussure. It is interesting in connection with the above to note that this large species has already become established in New York city and its vicinity, as stated by Mr L. H. Joutel.

This insect was first brought prominently to the attention of American entomologists in 1898 by Philip Laurent publishing a brief notice of its occurrence in the vicinity of Philadelphia in the issue of the *Entomological News* for June. In a later issue Mr Laurent states that he received the first specimen from Mr Mehan of the firm of Thomas Mehan & Sons in 1896. Later reports state that the insect has become well established in Philadelphia and apparently is able to hold its own in that climate. It appears to be thriving in the vicinity of New York city and may prove to be a valuable addition to our fauna, since it preys on other insects, and can hardly be otherwise than beneficial.

IMPORTANCE OF INJURIOUS INSECTS INTRODUCED FROM ABROAD[1]

One can not help being interested in the sources of our troubles; and the writer recently had occasion to look up some of the facts concerning introduced species, which, though they are well known, are worthy of further emphasis. It is generally conceded that some of our most troublesome insect pests are those which have made their way to us from abroad, and, while this is accepted as an authentic statement, its importance is not fully realized. The depredations of these introduced species are becoming more and more apparent, and the present indications are that in the future even more strenuous efforts must be made to subdue some of these insects. Let us glance briefly at the conditions in several portions of our country.

The commonwealth of Massachusetts now has within its borders two exceedingly injurious insects, which are bound sooner or later to make their way over a considerable portion of the United States. That commonwealth made a determined effort to exterminate the gipsy moth, Porthetria dispar Linn., and after the expenditure of over one million dollars abandoned the

1 Read before the Society for the Promotion of Agricultural Science at its meeting held in Washington D. C. Dec. 29, 1902.

task. The insect is now becoming more and more abundant, has established itself in Rhode Island and is gradually extending its range. The brown tail moth, Euproctis chrysorrhoea Linn., has also become established in that state, is known to occur in New Hampshire and Maine and is rapidly extending its range. The elms of that commonwealth are seriously injured by the imported elm leaf beetle, Galerucella luteola Müll., which has made its way over a considerable proportion of the state and is being assisted in its destructive work by the imported elm bark louse, Gossyparia ulmi Geoff. It would seem as if this might be sufficient, but apparently not, since the dreaded San José scale, Aspidiotus perniciosus Comst., is also established in a number of localities in that state and is proving true to its reputation in other places.

The condition of New York State is not much happier than that of its sister commonwealth, though as yet it is free from the gipsy and brown tail moths. Our elms, however, are badly injured from year to year by both the elm leaf beetle and the elm bark louse, and the shade trees in the vicinity of New York city are seriously ravaged by another imported insect, the leopard moth, Zeuzera pyrina Linn., a species which thrives in a large number of trees and when not checked inflicts extensive injuries. Our fruit trees are suffering here and there from excessive infestation by San José scale. The pear psylla, Psylla pyricola Forst., occasionally inflicts great injury on this fruit tree in various portions of the State.

In the South, we find the cotton boll weevil, Anthonomus grandis Boh., threatening the cotton crop of Texas, while the harlequin cabbage bug, Murgantia histrionica Hahn., has established itself in numbers in most of the southern states and is proving an exceedingly serious enemy of cruciferous crops. The imported peach scale, Diaspis pentagona Targ., is another recent introduction which has become established in several localities in the southern states and bids fair to rival in destructiveness the San José scale. It is also established in one or two localities in the north.

These are all insects which have been introduced into this country within comparatively recent years and which are proving pests of first importance. It is interesting in this connection to

observe where these and other introduced species first became established in the country. The gipsy and brown tail moths, Porthetria dispar Linn. and Euproctis chrysorrhoea Linn., were first detected in Massachusetts, while the elm bark louse, Gossyparia ulmi Geoff., the Hessian fly, Cecidomyia destructor Say, the common asparagus beetle, Crioceris asparagi Linn., the leopard moth, Zeuzera pyrina Linn., the Buffalo and black carpet beetles, Anthrenus scrophulariae Linn. and Attagenus piceus Oliv., and the European fruit tree scale insect, Aspidiotus ostreaeformis Curt., were first detected in New York State or its immediate vicinity, in the case of the leopard moth; and, according to recent reports, we may find that the nun moth, Psilura monacha Linn., has become established in the vicinity of New York city. Another imported insect, Coleophora limosipennella Dup., which may prove very destructive to elms, was recently brought to our attention on account of its occurrence in large numbers on Scotch elms in Brooklyn. The 12 spotted asparagus beetle, Crioceris 12-punctata Linn., was first detected in the vicinity of Baltimore, as is also true of the elm leaf beetle, Galerucella luteola Müll.

The few records given above indicate that a considerable number of the imported insects make their way to this country through the port of New York and naturally become established in the immediate vicinity of New York city or else at one of the great centers of the nursery trade in the western part of the State. Considerably fewer species come into the country through the port of Boston or through others south of New York. It may never be possible or practicable to attempt the establishment of a quarantine on our eastern coast, but it is certainly advisable for us to maintain a close watch (as is now done in New York by agents of the State Department of Agriculture) at these points of danger, in order that we may detect the advent of other injurious species and see that they are adequately controlled.

The injuries inflicted by the various imported insects are simply enormous and in most cases entirely beyond calculation. The

wheat midge, Diplosis tritici Fitch, inflicted in 1854, according to the estimates of Dr Fitch, a loss of $15,000,000 in New York State, or reduced the crop by about 7,000,000 bushels. A conservative estimate of the damage during the same year, by J. H. Klippart, secretary of the Ohio State Board of Agriculture, places the loss in that state at from 5,000,000 to 7,000,000 bushels. Two years later Dr Fitch estimated that from one half to two thirds of the wheat crop on the uplands of Livingston and Monroe counties was destroyed, and that nearly all of that on the flats, the latter comprising at least 2000 acres, was not harvested. Dr Fitch further states that the loss in 1857 probably exceeded that of 1854, and that one third of the entire crop, or about 8,000,000 bushels, was destroyed in Canada. The periodical injuries by the Hessian fly, Cecidomyia destructor Say, are well known, and it is not necessary to refer to them more than to mention that in 1846 it was estimated that in the western section of New York State there was a loss of not less than 500,000 bushels, and in our recent outbreak in 1901, the damage in New York State was placed at $3,000,000. Dr Marlatt has estimated that the loss in the Ohio valley on the crop of 1899-1900 amounted to from $35,000,000 to $40,000,000, and he places the minimum annual loss in the chief wheat growing sections of the country at 40,000,000 bushels and over. The exceedingly common codling moth, Carpocapsa pomonella Linn., is well known as a destructive insect; and it may be interesting to record Dr Forbes's estimate of $2,375,000 as the annual loss caused by it in the State of Illinois, while Professor Slingerland has placed the average damage in New York State at $3,000,000. In the southern states, enormous injuries by the cotton worm, Aletia argillacea Hübn., are well known. The average loss in the cotton states for the 14 years following the Civil War was estimated by Dr Packard at $15,000,000, and that for 1873 was placed by the same author at $25,000,000. Later, in 1877, he estimates the annual loss as ranging from $25,000,000 to $50,000,000. These are a few examples of what some of our introduced insect pests have done, and represent only a very small fraction of the entire loss, which in many cases can not be estimated with any approach to accuracy. It should perhaps be

added that the imported fluted scale, Icerya purchasi Mask., threatened the entire citrus fruit industries of California in the 80's and was effectually subdued only by the importation of natural enemies.

We have made an attempt to classify these imported insects according to their destructiveness or prospective importance; and the following annotated lists give our judgment regarding some of these forms.

INTRODUCED SPECIES OF PRIMARY ECONOMIC IMPORTANCE

Affecting fruit trees

San José scale, Aspidiotus perniciosus Comst. This species, though recently introduced, is already widely distributed over the United States and easily ranks as one of the most injurious scale insects in the country and is probably as destructive as any other imported form.

The black scale, Lecanium oleae Bern., is very injurious, particularly to oranges and lemons in southern California.

The codling moth, Carpocapsa pomonella Linn., is one of our older pests and yearly causes great losses, as mentioned in a preceding paragraph.

The brown tail moth, Euproctis chrysorrhoea Linn., is one of our most recently introduced species, which promises to be not only quite injurious to peartrees, but also very annoying to man, since the irritating hairs of its caterpillar have caused very serious inflammations, in neighborhoods where the insect was numerous.

The gipsy moth, Porthetria dispar Linn., though of comparatively recent introduction and still confined to a somewhat limited territory, is a species of prime economic importance and may eventually become one of the most destructive in the country. It fortunately spreads slowly and may be controlled locally.

The pear psylla, Psylla pyricola Forst., though first detected in Connecticut, probably entered the country through the port of New York and is exceedingly destructive to peartrees in some years. It has obtained a wide distribution in New York State and is known to occur as far west as Illinois.

Affecting shade trees

The elm leaf beetle, Galerucella luteola Müll., is a species which is at present confined largely to the Atlantic coast and during the last four or five years has been extending its range northward, particularly in New York and Massachusetts, where it has been exceedingly destructive, and easily ranks as one of the most serious enemies of elms.

The leopard moth, Zeuzera pyrina Linn., is limited largely to the vicinity of New York city, where it has proved very injurious to soft maples in particular, though it has been recorded as depredating on a great many other trees.

Affecting grains

The Hessian fly, Cecidomyia destructor Say, is a well known destructive species, which occasionally causes exceedingly severe losses and is more or less injurious every year in some section of the country.

The grain aphis, Nectarophora granaria Kirby, is exceedingly destructive in some years to grains in certain sections, and there is no practical method of controlling it.

A grain louse, Toxoptera graminum Rond., is a recent introduction and has proved very injurious to wheat in Texas.

Affecting cotton and other crops

The cotton worm, Aletia argillacea Hübn., is a well known and exceedingly injurious insect in the South.

Its associate, the boll worm or corn worm, Heliothis armiger Hübn., is exceedingly injurious and may have had a foreign origin.

The cotton boll weevil, Anthonomus grandis Boh., is a species which has recently become established in Texas, where it has already inflicted enormous damages and is proving exceedingly difficult to control.

The hop plant louse, Phorodon humuli Schrank, is a serious enemy of this crop, which occasionally causes very great losses and is more or less destructive each year.

The cabbage maggot, Phorbia brassicae Bouché, is very destructive to cabbages in various sections of the United States and has led to the abandonment by many growers of early cab-

bage, cauliflowers and radishes about New York city, according to Peter Henderson, who records the destruction of tens of thousands of acres in 1887.

The destructive pea aphis, Nectarophora pisi Kalt, is a species which has caused widespread loss to extensive pea-growers in the Atlantic states and has led many to abandon the late varieties in order to escape its ravages.

RECENTLY INTRODUCED SPECIES WHICH MAY BECOME VERY DESTRUCTIVE

The sinuate pear borer, Agrilus sinuatus Oliv., is established in the vicinity of New Brunswick N. J.

The recently imported West Indian peach scale, Diaspis pentagona Targ., is very injurious where established in the southern states and is known in a few localities in Massachusetts.

The European fruit tree scale insect, Aspidiotus ostreaeformis Curt., is established in New York State and in a number of other localities in this country, but as yet has not proved markedly injurious.

The wheat sawfly, Cephus pygmaeus Linn., has become established in several localities in this country, but has not proved very injurious, though it is a well known enemy of wheat in Europe.

An interesting case-bearer, Coleophora limosipennella Dup., was brought to the speaker's notice last year, when it was inflicting considerable injury on Scotch elms at Brooklyn. It is apparently a recently introduced species.

The willow and poplar curculio, Cryptorhynchus lapathi Linn., has become established in a number of widely separated localities and has proved quite injurious to nursery and other young trees in particular.

OTHER INTRODUCED SPECIES

Most of the forms included in this list are quite destructive at times, though not as a rule so injurious, or likely to become so, as those in the preceding lists. Most of them are so familiar that comment is unnecessary.

Species affecting fruit trees

Pear midge, Diplosis pyrivora Riley

Bud moth, Tmetocera ocellana Schiff.

Cherry and pear slug, Eriocampoides limacina Retz.
Apple aphis, Aphis mali Fabr.
Cherry aphis, Myzus cerasi Fabr.
Pear blight beetle, Xyleborus dispar Fabr.
Fruit tree bark beetle, Scolytus rugulosus Ratz.
Appletree bark louse, Mytilaspis pomorum Bouché.
Orange bark louse Mytilaspis citricola Pack.
Greedy scale insect, Aspidiotus camelliae Sig.
Fluted scale, Icerya purchasi Mask.

Species affecting small fruits

Currant sawfly, Pteronus ribesii Scop.
Currant stem borer, Sesia tipuliformis Linn.
Rose scale, Aulacaspis rosae Sandb.

Species affecting miscellaneous crops

Larger cornstalk borer or sugar cane borer, Diatraea saccharalis Fabr.

Common asparagus beetle, Crioceris asparagi Linn.

12 spotted asparagus beetle, Crioceris 12-punctata Linn.

Cabbage aphis, Aphis brassicae Linn.

Harlequin cabbage bug, Murgantia histrionica Hahn.

Onion maggot, Phorbia ceparum Meig.

Seed corn maggot or locust egg anthomyian, Phorbia fusiceps Zett.

Variegated cutworm, Peridroma saucia Hübn.

Xylophasia arctica Bdv.

Cabbage butterfly, Pieris rapae Linn.

Cabbage worm, Plutella cruciferarum Zell.

Imported cabbage webworm, Hellula undalis Fabr.

Carrot rust fly, Psila rosae Fabr., has been known in Canada for some years and was first detected in New York State in 1901.

Clover leaf weevil, Phytonomus punctatus Fabr.

Mamestra trifolii Rott.

Clover root borer, Hylastes trifolii Müll.

Clover hay worm, Pyralis costalis Fabr.

Prolific Chlorops, Chlorops variceps Loew.

Affecting forest trees

Larch sawfly, Lygaeonematus erichsonii Hart.

Woolly larch aphis, Chermes strobilobius Kalt.

Birch seed midge, Cecidomyia betulae Winnertz

The European willow gall midge, Rhabdophaga salicis Schrank, was recently detected by us in central New York, where it has caused considerable injury by infesting willows grown for binding nursery stock.

Golden oak scale insect, Asterolecanium variolosum Ratz.

Elm bark louse, Gossyparia ulmi Geoff.

Affecting domestic animals

Horn fly, Haematobia serrata Rob.-Desv.

Screw worm, Lucilia macellaria Fabr.

Enemies to stored food products

This list comprises a number of widely distributed species, a few of which are exceedingly destructive.

Mediterranean flour moth Ephestia kuehniella Zell. This species is the most destructive mill pest known in the country, and when abundant may necessitate the cessation of operations and thorough cleansing before grinding can be resumed.

Indian meal worm, Plodia interpunctella Hübn.

The rice weevils, Calandra granaria Linn. and C. oryzae Linn.

The bean weevil, Bruchus obtectus Say.

The pea weevil, Bruchus pisi Linn.

Insects annoying or injurious in houses

This group comprises practically all of our species, as may be seen from the following list.

Case-making clothes moth, Tinea pellionella Linn.

Southern clothes moth, Tineola biselliella Hum.

Tapestry moth, Trichophaga tapetzella Linn.

Buffalo carpet beetle, Anthrenus scrophulariae Linn.

Black carpet beetle, Attagenus piceus Oliv.

Larder beetle, Dermestes lardarius Linn.

Little red ant, Monomorium pharaonis Linn.

House fly, Musca domestica Linn.
The bed bug, Acanthia lectularius Linn.
The cockroach, Periplaneta orientalis Linn.
The American cockroach, Periplaneta americana Linn.
The croton bug, Phyllodromia germanica Fabr.

Beneficial species

The general record concerning introduced species is not pleasant reading, but that of the forms which aid in subduing insect pests is one of the brightest pages of American economic entomology. The first prominent success met with in introducing predaceous enemies was the importation of the Australian ladybug, Novius cardinalis Mul., which was introduced in 1889 in hopes that it would check the destructive fluted scale, Icerya purchasi Mask., which then threatened the entire citrus industry of California. These hopes were realized in a most gratifying manner, and the ravages of that scale are now a matter of history.

Another valuable importation is that of the fig insect, Blastophaga grossorum Grov., a species which is absolutely essential for the production of the best quality of figs, and its presence has made possible the growing of the celebrated Smyrna figs in California. This was accomplished largely through the division of entomology of the United States Department of Agriculture and is another of the signal triumphs of applied or practical entomology. Another very recent importation, which may possibly prove of greatest practical benefit to American horticulture, is that of the Chinese ladybug, Chilocorus similis Rossi, a species which feeds readily on the San José scale and may eventually prove a very efficient factor in controlling it.

A list of the more important beneficial insects which have become established in this country is as follows:

A parasite of the fluted scale, Lestophonus iceryae Will.
The fig insect, Blastophaga grossorum Grov.
Hessian fly parasite, Entedon epigonus Walk.
Scutellista cyanea Motsch., a parasite of the black scale insect.

Cardinal ladybug, Novius cardinalis Muls.

Australian ladybugs, Novius koebelei Olliff and N. bellus Blackburn.

Chinese ladybug, Chilocorus similis Rossi.

Black ladybug, Rhizobius ventralis Erich.

A predaceous enemy of bark borers, Clerus formicarius Linn., introduced from Europe in 1892 by Dr A. D. Hopkins as a valuable predaceous enemy of certain very injurious bark borers.

European praying mantis, Mantis religiosa Linn.

Chinese praying mantis, Tenodera sinensis Sauss.

The two latter were accidentally brought into the country; and, while we expect that in the main they will be beneficial, apprehension is felt by some, and their introduction may not prove to be an unqualified benefit.

EXPERIMENTAL WORK AGAINST SAN JOSÉ SCALE INSECT

The experimental work against this insect begun in 1900 and continued in 1901 was further prosecuted during the past season, and the results of earlier years were largely confirmed.

The lime, salt and sulfur mixture, about which considerable has been written in the past 12 months, was also tested, and some valuable data obtained under various conditions. The results in earlier years from spring applications of whale oil soap in combination with crude petroleum and kerosene or its emulsions were such that it was not deemed advisable to continue further work with these substances. The combination of the soap with petroleum reduced the insecticidal value of the latter and made a somewhat safer combination, but increased the cost of the emulsion, so that its use can be advised only when no mechanical emulsion apparatus is at hand. The kerosene and its emulsions proved so unsatisfactory in early spring applications that no further work was attempted with it.

Fall applications

All our previous work had been done in early spring just before the buds began to open or just as they were unfolding, and though the results were exceedingly satisfactory some tests with fall applications were planned. These were all made Dec.

11, 1901. The day was an ideal one, there being very little or no wind most of the time and the temperature ranging from about 30° in the shade to 68° in the sun. The trees were dry, and, despite the fact that there had been considerable cold weather and much snow the previous week, the trunks of the trees, even to the very base, were well exposed; consequently the insecticide could be applied to the greatest advantage. Most of this experimental work was limited to an exceedingly badly infested orchard of young appletrees near Albany. A number of these were dying and a considerable proportion of them were in extremely bad condition, owing to the work of this scale insect.

20% mechanical crude petroleum emulsion. This mixture was applied to 23 appletrees in the above mentioned orchard. The oil was obtained of the Derrick Oil Co. of Titusville Pa., and, after being drawn from the barrel, tested 41.1° on the Beaumé oil scale. The spraying was carefully done, and, under the exceptional weather conditions noted above, practically every portion of each tree was covered with the mixture. The sprayed trees were numbered 344-66, and their condition at the time of spraying was as follows: nos. 344–347, 349, 350, 353, 355, 355a, 357, 361–363 were all very, very badly infested with the scale, a large proportion of the bark being literally covered by the pest. Trees 348, 352 and 359 were dead. Tree 351 was very badly infested, and trees 354, 358 and 364 were rather badly infested. A few scales were to be seen on tree 360, 365 was badly infested, and only a stump remained of tree 356.

In addition to the appletrees named above a number of other kinds of fruit trees on adjoining premises were sprayed with the crude petroleum. Most of these trees were in a fairly vigorous condition, though a few were somewhat badly infested by the scale.

An examination of the appletrees in midwinter raised considerable apprehension and it was feared that the insecticide had caused serious injury, but investigation Mar. 10 showed that the crude petroleum had not damaged the trees so much as was feared. The tips of some branches were dead, and a number of trees had died during the winter; but, as most of them were in very bad condition on account of scale infestation, it is hardly fair to attribute all the damage to the insecticide applied. In

most instances the living bark of the trees ranged from slightly green to a perfectly healthy green, and it was then expected that a goodly proportion would develop a fair amount of foliage. All the scale insects appeared to be killed. One peachtree in an adjoining orchard, which had been sprayed at the same time and under similar conditions with the 20% mechanical emulsion, was examined in March, and it was found that the fruit buds had apparently escaped all injury.

An inspection of the same trees May 6 showed that a number had died, though this is not surprising after allowing for the injuries by the scale insects and also for the damage done by the round-headed borer, which was exceedingly abundant in the orchard. The trees sprayed with the crude petroleum emulsion showed little or no more injury than those beside them treated with whale oil soap, and we are therefore inclined to believe that the petroleum inflicted relatively little injury.

This mechanical emulsion, as previously stated, was applied under the same conditions to other trees, and the observations made on them are of considerable interest. May 6 these other sprayed trees were examined with the following results. A Dutchess pear showed a few dead limbs, was not badly infested and bade fair to produce some blossoms. Another of the same kind was leafing out nicely and gave evidence of producing a number of blossoms. A Globe peachtree presented a very fair bloom, though some limbs were dead at the tips. The latter we are inclined to believe was due to the weather of last winter, because similar injury was observed on a number of untreated trees. Meeches prolific quinces, of which several bushes were treated, were in excellent condition and had an abundance of flowers. Several Bartlett peartrees possessed a very good foliage and an excellent bloom.

These and some other trees treated with crude petroleum emulsion the preceding December were also observed June 12 with the following results. A Lombard plumtree was found to be nearly uninjured by the oil, while several Clapp's favorite peartrees were hurt to some extent, the bark cracking in places in the case of one tree and none bearing any fruit. Some injury and no fruit was true of a Bartlett peartree, while another bore considerable fruit and two others some. A Botan plumtree had

several limbs killed by the oil, but the others were apparently all right. A Kieffer peartree was in excellent condition and had a little fruit. One Dutchess pear was apparently uninjured and bore no fruit, while another would produce some. Practically the same results were obtained on Beurre d'Anjou and Vermont Beauty peartrees. The Meeches prolific quincetrees bore out the promise of an earlier date and gave no evidence of having suffered in the slightest from the application. A yellow Gage plum was in excellent condition but bore no fruit, and the same was true of a natural cherry, except that it had a little fruit. A Magnum Bonum plum was in excellent condition and bore considerable fruit.

An examination of the apple orchard June 12 failed to reveal a single living scale insect; and, though some of the trees had developed adventitious shoots, their occurrence could hardly be attributed to the use of the oil, since they were almost equally common on the trees sprayed with whale oil soap. The plumtrees sprayed with the crude petroleum also developed a considerable number of adventitious shoots, and it is possible that they were injured by the oil, though such is not necessarily the case.

An examination of these trees Nov. 11 by my assistant, Mr Walker, showed that a few were very badly infested by the scale, that some were badly infested and that several were dead. The owner, since the treatment of the previous fall, had set a number of new trees in vacant places. Most of these and some of the others were in good condition.

In passing judgment on this experiment, it should be remembered that no treatment whatsoever was given after the spraying in December, and that, before the end of the season, the few scale insects which presumably escaped destruction had an excellent opportunity to multiply. Up to the middle of the summer at least there were very few living scale insects to be seen on these trees; and we can not help feeling that, while the insects are now abundant on a number of the trees, the application proved very efficient and was perhaps as effective, though somewhat injurious, as any spray which could be applied.

Good's caustic potash whale oil soap no. 3. This insecticide was applied at the rate of 2 pounds to the gallon to 315–28 and

331-43 in the above named young apple orchard and under conditions previously described. The condition of these trees so far as noted at the time of treatment, Dec. 11, 1901, was as follows. Trees 317, 320, 321, 322, 323, 324, 325, 326, 327, 333, 334, 335, 336, 338, 340, 341 and 342 were extremely badly infested with the scale; trees 319, 330, 332 and 343 were very badly infested, and trees 316 and 331 were rather badly infested; there were only a few on tree 339 while trees 315, 318, 328 and 337 were dead. 34 other fruit trees on an adjoining place were also sprayed with this solution, except that a little of Good's tobacco whale oil soap no. 6, 2 pounds to the gallon, remained in the barrel when the solution of no. 3 was added. There was however very little of the tobacco whale oil soap solution, and the effect would hardly be modified.

The examination of the above mentioned trees Mar. 10, 1902, showed that apparently all of the scale insects had been killed by the treatment, and so far as noted no injury to the trees occurred. The same was true of a later examination made May 6, and there was no material change in conditions so far as noted June 12. An examination of the appletrees Nov. 11, 1902, by my assistant, Mr Walker, showed that a few of the trees were very badly infested, some badly infested and others in good condition. The application appears to have checked the pest very thoroughly till toward the latter end of the season, when the few which survived the treatment were able to multiply and reinfest the trees to a considerable extent.

Good's tobacco whale oil soap no. 6. This compound was used in a solution of 2 pounds to the gallon and was applied to 11 small appletrees in the above described orchard and to nearly 20 greengage plumtrees on the northern boundary of the same. The condition of the appletrees at the time of spraying was as follows. Trees numbered 303, 307, 308 and 313 were very very badly infested. Trees 305, 310 and 314 were dead except in the case of 310, which had developed a few suckers; 311 was nearly dead. There were a few scales to be seen on trees 304, 306 and 312, and 309 and 311 were very badly infested.

An examination of these trees Mar. 10 showed that apparently every scale insect had been destroyed by the application, and the same was true of a later examination May 6. This condi-

tion was not materially changed June 12, and an examination Nov. 11 by my assistant, Mr Walker, showed that two were very badly infested, some others badly infested and a few in a good condition. This row of trees was in such bad condition at the outset, and so many of them were nearly dead or had died during the winter, that the actual record does not do justice to the insecticide. Comparative observations led us to believe that this tobacco whale oil soap solution was possibly a little more effective in destroying scale insects than the more commonly employed caustic potash whale oil soap no. 3.

Linseed oil. Several trees were carefully painted with this substance Dec. 11, 1901, by my assistant, Mr C. M. Walker. The treated trees were as follows: tree 226, a small apple, and 227, a small peach, and 330, a very badly infested appletree, were painted with the boiled linseed oil. The raw linseed oil was similarly applied to an exceedingly badly infested appletree, no. 329. It was found that a small tree required about ½ pint of the oil, and nearly two hours were occupied in applying the substance.

Mar. 10 the linseed oil could be easily seen on treated trees, and on May 6 it was seen that two appletrees, 329 and 330, were in a very serious condition and likely to die. June 12 it was found that 330, which was painted with the boiled linseed oil, was killed back to the stump and was then developing a very few shoots, while tree 329, which received the raw oil, was dead. This substance undoubtedly killed the scales and was apparently almost equally destructive to the trees. Its use in the fall certainly can not be advised.

Spring applications

The tests with various sprays in early spring were continued last spring, and the results of earlier years have been largely confirmed.

20% mechanical crude petroleum emulsion. This mixture was applied Ap. 7 to about 70 trees, representing a number of the more common varieties. The day was cloudy, and the trees were damp at 11 a. m., so that no spraying was undertaken till 1 p. m., at which time the trees were dry, though it was not what would be characterized as a drying day. The buds of some varieties of

pears had begun to open. This insecticide was applied to the following trees: 15-28, 34-47, 60-74, 79-91, and 101-14, or in other words, to the western end of our experimental orchard, a map of which was published in our report for 1900. The general character of the trees and their varieties have been previously published and can be ascertained by referring to the above report. Tests of the mechanical dilution were made while the work was in progress with the following results. At tree 19, 5% oil was delivered; at tree 87, a little over 12.3%; at tree 108, 14%; at tree 104, 12.5%; and at tree 35, 21.5%. Tree 83 was resprayed, because very little oil was delivered with the apparatus at the first attempt on account of the petroleum being low in the reservoir. The above figures vary much more widely than those of any tests previously made with this apparatus, and their divergence may have been due to the pump being somewhat out of order, though the precise trouble was not located.

The next day it began to rain about 10 a. m. and ceased about noon, beginning again at 1 p. m., and poured from about 1.30 to 2 p. m., but it did not cease raining till 3 p. m. On the 9th it rained some during the night and drizzled or rained most of the time between 8 a. m. and noon. It rained some most of the afternoon and during the night, and on the 10th it rained from 11 a. m. to 3 p. m., also during the night and on the nights of the 11th and 12th. The weather bureau records at the Albany station, less than 3 miles from the experimental orchard, give the precipitation as follows: .01 in. on the 7th; .22 on the 8th, .35 on the 9th and .20 on the 10th, a total of .78 in. or practically one third of the rainfall during the month on the day of and the three following the application.

An examination of the trees sprayed with oil showed that they were apparently well covered, and the smell of petroleum was very marked in the orchard. The rough bark on some of the trees seemed to have absorbed the oil pretty thoroughly, but on the smooth bark there was an abundance, as very little or none had evaporated. The oil remaining on the trees for so long a period with comparatively little evaporation was most favorable to injury if such would be produced, and consequently a number of the trees were examined closely May 6, with the following

results. Tree 113 was in very full bloom, showing that the fruit buds had suffered no injury. Tree 114 had a number of open blossoms and many unfolding buds. The latter had been seriously injured by the scale in earlier years and was recovering very nicely [pl. 2]. Tree 47 had many blossoms on it, though they were somewhat sparse, while 41 produced a very large number. Tree 101 bore a considerable number of opening blossoms. Trees 17-19 showed a slight blistering on the smooth bark, due probably to the application of crude petroleum, but, so far as could be discovered, no appreciable injury had been done. It should also be stated that the bloom of peachtrees in general was not full, so that a scarcity on the sprayed trees was not necessarily due to the insecticide used [pl. 5].

An examination June 12 showed that the petroleum was still apparent on the trees, but signs of its presence were limited very largely to a darker, more moist appearance of the bark. There was very little or no odor of the oil in the orchard.

An examination June 20 showed that tree 28 bore some living females, and that young were found under the scales in small numbers. Tree 73 was very badly infested with young scales last spring, and these had been mostly destroyed. Living females were found only on the underside of the branches, in places where they were badly incrusted. The bark of this tree had cracked to some extent, probably owing to the oil. Trees 23 and 60 had some living scales, and the bark of each was very rough. Tree 103 was in excellent condition and had made a very satisfactory growth, for in 1900 it was very badly infested, and now the bark on the lower limbs and trunk is very rough. Tree 101 has a poor shape, owing to the death of limbs, resulting in all probability from the application of undiluted crude petroleum in 1900, but it is now making a fine growth. It has thrown out many suckers, which is due probably to its previous hard treatment. The bark of the lower limbs and trunk is very rough.

A detailed examination of these trees was made July 5 with the following results. There were few or no young on the following trees, 17, 19, 24, 26, 27, 34, 35, 42, 45, 46, 60, 62, 63, 64, 66, 70, 71, 74, 80, 81, 87, 88, 89, 90, 91, 101, 102, 103, 104, 109, 110, 111, 112, 113; there were few or very few young on the

following trees, 18, 25, 36, 37, 38, 40, 41, 43, 47, 65, 79, 82, 83, 84, 85, 105, 106, 108; young were rather abundant on trees 15, 16, 21, 22, 23, 28, 44, 61, 68, 69, 114; and young were very abundant on tree 73.

These trees were again carefully inspected Nov. 11 by my assistant, Mr Walker, who rated them as follows. Condition good, trees 15, 16, 17, 18, 19, 24, 25, 26, 27, 34, 35, 36, 37, 42, 43, 44, 45, 47, 60, 61, 62, 63, 64, 65, 66, 68, 71, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 101, 102, 103, 104, 105, 106, 109, 110, 111, 112, 113, and 114. The following were classed as being in a bad condition, that is having on them a number of living scale insects, trees 21, 22, 23, 38, 40, 41, 69, 70, 108; and trees 28 and 73 were rated as being very bad.

It will be seen by the above that only two trees were in very bad shape at the end of the season, and both of these were badly infested when the spraying was done last spring. Many of those classed as being in bad condition have the bark of the larger limbs and trunk rough, and this interferes materially with the efficiency of the insecticide. A comparison of the condition of these 70 trees with the 50 at the other end of the orchard sprayed with lime, salt and sulfur mixture is quite marked and emphatically in favor of treatment with the oil. It should be stated however that the relative inefficiency of the lime, salt and sulfur mixture was probably due to the rains following so shortly after application and continuing so long [*see* page 132]. These had practically no effect on the oil and therefore gave it the advantage.

The writer at the outset raised the question as to the possibility of injury resulting to trees which had been sprayed with petroleum for successive seasons, and now he is in a position to supply a little data on this question. Trees 25-28, 41-47 and 101-14 have received applications of crude petroleum for three successive seasons. Tree 101, a seckel pear, was very badly infested in 1900 when it was sprayed with undiluted petroleum and sustained serious injuries. The following year it was sprayed with a mechanical mixture, consisting of 15% oil and a whale oil soap solution, 1 pound to 4 gallons. Last spring it was sprayed with the 20% mechanical emulsion. This tree was in very bad condition at the outset, and, as above noted, was

seriously injured by the first application. It has been steadily improving and now is in a vigorous condition, has developed a large amount of new wood and bids fair in another year or two to have a symmetric, good sized head. The twigs made a growth of 8 to 12 inches during 1902 [pl. 3]. Tree 114, a pear of the same variety, was sprayed in 1900 with undiluted crude petroleum but was not injured so much as no. 101. It was treated last year with 20% mechanical crude petroleum, which was obtained from Titusville, and this year again with a 20% petroleum emulsion. It is in vigorous condition and much better off than two years ago [pl. 2]. Tree 69, a Howell pear, was treated in 1900 with whale oil soap and petroleum and with a mechanical emulsion of the latter in 1901 and 1902, and is now flourishing [pl. 3]. The same is practically true of tree 66, a Bartlett pear [pl. 2]. Tree 25 is a Beurre Bosc pear, which was very badly infested in 1900. Trees 26 and 27 are Kieffer and tree 28 a seckel pear; the latter was also very badly infested in 1900. At the end of 1900 young were reported as abundant on tree 28, and the same was true at the end of 1901. The very bad condition of the tree at the end of 1902 is probably due to the fact that it is in a corner which was rather difficult of access, and this may have had some influence on its treatment in earlier years. Tree 41 is a Crawford peach, and trees 42-45 and 47 are Old Mixon peachtrees. Trees 42 and 43 were very badly infested in the spring of 1900, but since then have developed little scale, and all are in as good, if not better, condition than two years ago last spring, and several of them bore very fair crops of fruit this year [pl. 5].

These cases go far toward showing that successive applications of crude petroleum, if carefully made, will not injure trees, and that those which are very badly infested can be freed from the scale to a considerable extent and brought into a profitable bearing condition.

Experiments at Highland. A 20% mechanical crude petroleum emulsion was applied Ap. 1 to 52 plumtrees, mostly Abundance and a few Burbank. The trees had been covered with ice and snow by a storm during the night and had just dried. The weather at the time of spraying was sunny, rather cool, and considerable wind was stirring, but the trees were well covered with

the insecticide. Samples of the emulsion taken near the beginning, the middle and end of the spraying gave respectively 17%, 13.6% and 15.6% of oil. These samples were taken while spraying under a reduced pressure and from both nozzles. This variation is greater than any recorded in previous years and may have been due to the apparatus being somewhat out of order. Sunday, the 6th, 7/8inch of rain fell, and between that and the 11th, 1¾ inches more. The weather was such that no spraying was attempted between the initial application and the latter date.

An examination July 7 showed that about all of the trees sprayed with the emulsion were infested with from very few to rather abundant young scale insects. They were found almost entirely near the center of the rows. There was no evidence to show that the fruit buds had been affected in the slightest by the application.

An examination Nov. 25 showed that the trees were in very good condition. There were a few living scales on every one, and in a few cases they might be classed as somewhat abundant, but in no instance were there enough to interfere with the health of the tree. The general results were very satisfactory. All of the treated trees were in very thrifty condition and bore immense numbers of fruit buds.

Experiments at Warwick. About 50 old peachtrees were sprayed with 20% crude petroleum emulsion on Mar. 25, which was a bright, sunshiny day, though in the afternoon there was some wind. The trees in this old orchard are from three to five or seven years of age, some of them being 15 feet high. Two rows of small, three year old peachtrees, about 60 in number, on a hill, were also sprayed on the same day for the special purpose of ascertaining the effect of the insecticide on the fruit buds. The wind blew some, and practically all of the trees were well covered with the insecticide. Samples of the emulsion were taken at the beginning, middle and end of the spraying in the old orchard and gave respectively 21%, 36% and 32% of oil. This variation must have been due to the taking of the samples from one nozzle and under a lower pressure than that employed in most of the spraying. Another sample taken in the middle of the spraying of the two rows of young trees on the hill gave but 14% of oil.

An examination July 8 showed that the trees near the northern end of the old orchard have very little or no scale, except in one instance. In this case the tree was very badly infested, the bark was quite rough, and the living young were very abundant. Quite a number of the treated trees bore considerable fruit. The trees in the young orchard showed very little or no injury except in a very few cases where possibly an excessive amount of oil was applied. A very few living scales were found on some of the trees and none on many.

An examination Nov. 24 did not give satisfactory results in the old orchard, since some of the trees were comparatively free from living insects, while others were rather abundantly infested. The latter, however, were trees with very rough bark, which probably had considerable to do with the insects escaping destruction. The condition of the trees in the young orchard on the hill was much more satisfactory, and there were very few scale insects to be found on those sprayed with the oil. The trees did not show the slightest injury, except in one or two instances, and this may have been due to other causes, since they had made an excellent growth during the summer and had developed numerous fruit buds.

Summer spraying. The application of even a mechanical crude petroleum emulsion to trees in full foliage has not been recommended in the past, and the writer does not feel justified in doing so at present, in spite of the fact that his attention was called last summer to a very badly infested peach orchard in the southern part of the State, which had been sprayed while in full leaf with 20% and 25% mechanical crude petroleum emulsion. The applications were made at this time because it had just been discovered that the orchard in question was very badly infested with the San José scale, and it was felt that even heroic measures should be resorted to in order to check the pest. The spraying was done July 7, and the following day many of the trees were literally dripping with the oil, and the same was true of the weeds underneath, though we failed to note any injury. This work was done on the recommendation of Mr P. L. Huested, San José scale inspector of the State Department of Agriculture, and this gentleman reports that, so far as he has been able to discover, the trees have not suffered from this treatment, except that con-

siderable foliage dropped from parts where it was thickest and evaporation presumably much slower. This was particularly true where the 25% emulsion was freely used.

Good's whale oil soap no. 3. About 35 peachtrees in the old peach orchard at Warwick were sprayed with this substance, using 2 pounds to the gallon. The application was made on Mar. 24 and 25, and the weather was bright and sunny, and there was practically no breeze while the spraying was in progress. No rain fell till Friday afternoon, the 28th, when it commenced to drizzle, and it poured during the night.

An examination of these trees July 8 showed that there were very few living young on those near the northern end of the orchard. There were perhaps a few more scale insects than on those treated with the lime, salt and sulfur mixture. The setting of the fruit was apparently unaffected by the application. A number of young trees in the young orchard on the hill, sprayed by Mr Williams with this substance, using 1¼ pounds to the gallon, had a few scales, while many were perfectly free. The application was hardly as effective as the crude petroleum. Some unsprayed trees on the eastern side of this small orchard had from a few to many scales, while there were very few or none on most. It should be stated that the San José scale does not appear to have thriven in the orchards where the experiments were conducted, and consequently the results are not so decisive as might be wished.

An examination Nov. 24 failed to give anything decisive in the old orchard, where conditions, so far as experimental work was concerned, were far from satisfactory. The trees, generally speaking, were in better shape than those sprayed with the crude petroleum, and in nearly as good condition as those treated with lime, salt and sulfur. The most marked results were observed in the young orchard on the hill, where a large number of the trees, as previously stated, were sprayed last spring with 1¼ pounds of soap per gallon. These trees were not, generally speaking, as free from the scale as the young trees which had been sprayed with the mechanical crude petroleum emulsion, but none of them were seriously infested, and a great many were comparatively free from living insects. There was a striking difference to be observed between these and others which were

not treated. The latter were in some cases very badly infested, having entire limbs nearly incrusted with thrifty scale insects.

Lime, salt and sulfur mixture. This compound was applied to about 50 trees in the eastern end of our experimental orchard; and the results obtained from this test differ somewhat from those in other parts of the State under somewhat different conditions. The following formula was used: 10 pounds of lime and 20 pounds of sulfur were thoroughly boiled in 20 gallons of water for one and one half hours, or till the sulfur was dissolved, which was indicated by the solution assuming an amber color. This mixture was stirred frequently during the boiling, and then 30 pounds of lime, which had previously been thoroughly slaked by pouring hot water over it, and in which 15 pounds of salt had been dissolved by stirring, was added to the boiling lime and sulfur mixture. The whole of this mixture was cooked half an hour, being thoroughly stirred from time to time, and then enough water was added to make 60 gallons. The mixture was thoroughly strained through gunny sacks and sprayed as soon as possible, so as to apply it when hot. The mixture used in the experiments under consideration was boiled very thoroughly, and there can be no question as to its having been properly prepared.

Trees 4-14, 29-33, 49-59, 75-78 and 92-100 were treated with this preparation, as well as 20 to 25 large plumtrees in an old orchard just north of the experimental plot. The work was completed about 5 o'clock in the afternoon, and no rain was observed to fall till about 10 o'clock of the following day. There was however very little drying of the spray, since the atmosphere was humid most of the time. The exact record of precipitation is given above under the 20% mechanical emulsion, p. 132.

An examination of these trees Ap. 11 showed that, while they were apparently well covered with the mixture, in reality the rain had washed the finer portions against the rougher projections on the bark and had also caused it to gather in masses on the smooth bark of the limbs. It is very probable that much of the more soluble material had been carried away, or deposited in spots here and there on the tree, much to the detriment of the application.

An examination of the treated trees May 6 showed that the signs so visible on the previous inspection had nearly disappeared. The only indication of the presence of the insecticide was a somewhat bluish color, except in the case of one or two trees, where the lime, salt and sulfur solution appeared to have lodged in masses and gave the trunk a somewhat speckled condition. Tree 4 produced a large number of flowers [pl. 4], and 95 had a very fair bloom.

An examination of a few trees June 20 showed that there were many living young on the underside of the limbs of tree 14. There were some living scales to be found in some positions on tree 13, and living females were abundant on the underside of the limbs of tree 12.

A detailed examination of the trees was made July 5 with the following results. There were few or no young on trees 4, 5, 6, 8, 31, 50, 55, 56, 57, 58, 76, 96, 97, 98, 99; there were few young on trees 10, 13, 32, 33, 49, 51, 59, 92; young were rather few on trees 29, 30, 52, 77 and 100; they were rather abundant on trees 7, 11, 14, 53, 78, 95; and they were very abundant on tree 12.

Examination of these trees Nov. 6 by my assistant, Mr Walker, led him to rate them as follows. He found live females and young on trees 4 and 5 and dead young on number 6; numbers 7-14 inclusive were in very bad condition; the same was true of 29-33 and of 49-53, 55-59, 76-78 and 95-98. The status of tree 54 was doubtful, and 93 and 94 had been removed. No living scale was found on tree 92.

This is quite different from the other end of the orchard, and it was so marked that it was comparatively easy to distinguish between those treated with the lime, salt and sulfur and those with crude petroleum, simply by the number of scale insects on them. It should be pointed out however that this test was an unusually severe one; and, while these facts tend to throw considerable doubt on the value of this material, they do not condemn it. It is possible that the lime, salt and sulfur mixture will prove to be one of our most valuable methods of controlling this scale insect, since Mr L. L. Morrell, of Kinderhook, who used the material under the writer's directions, obtained most satisfactory results, and reports from others have

been equally good. It will require more than one season's work to determine the exact status of this material in New York State, and at present we can only advise its use in a provisional manner.

Experiments at Highland. A number of young plumtrees, 13 Abundance and 13 Burbank, were sprayed Ap. 1 with the lime, salt and sulfur mixture prepared according to the formula given above. Some trouble occurred in this case, because the boiler was small and would not hold 10 gallons at once. It was therefore impossible to add all the lime and salt and boil for half an hour. The matter was further complicated by the boiler leaking after a part of the lime and salt had been added and boiled perhaps for 25 minutes. The whole had to be removed, placed in a barrel, the additional lime and salt added, and then to that was added considerable hot water, and the mixture covered and allowed to remain undisturbed perhaps an hour in the hope that the heat would complete the chemical action. The trees sprayed with this mixture were completely dry. The day was sunny and rather cool with considerable wind. All of the trees were sparsely infested with San José scale. No rain fell till the 6th, when there was a precipitation of 7/8 inch, and from then to the 11th an additional 1¾ inches fell. The weather was such that no spraying had been possible since the first treatment.

An examination of the sprayed trees July 7 showed that there were very few living young, and that the mixture was apparent on the trees only as slightly white particles, which rendered the detection of the white, young scale insects very difficult. The application has undoubtedly killed a large proportion of the insects. Some other trees sprayed with lime, salt and sulfur, said to have been prepared according to the same formula but boiled only about half as long, were examined. The insecticide was much more apparent on the latter, and possibly it was more effective. In neither case did the mixture injure the fruit buds.

An examination Nov. 25 showed that the experimental trees were in excellent condition and, if anything, perhaps a little freer from the scale than those treated under similar conditions with the 20% mechanical petroleum emulsion. The trees above the experimental row were also sprayed later with lime, salt and sulfur mixture, which was boiled for a relatively short time, and considerable of the mixture was still to be seen on the northeast

side of the trunks and also on the underside of the larger branches. The condition of these trees was nearly as satisfactory as those of the experimental row sprayed by the writer.

A large number of trees below the experimental rows were also sprayed later with the lime, salt and sulfur mixture, which had been boiled till the amber color was very apparent, and the application was fully as thorough, according to the statement of the owner. A considerably larger number of living scale insects occurred on these lower rows, which may possibly be due to the fact that these trees were somewhat more infested in the spring; though this hardly seems an adequate explanation for the difference.

The extended breeding period of the San José scale was strikingly illustrated by finding a few living young and a great many in the white stage at the late date of Nov. 25. All the treated trees were then in a very thrifty condition and bore immense numbers of fruit buds.

Experiments at Warwick. The same mixture was applied Mar. 24 and 25 to some old peachtrees in the town of Warwick, Orange co. The mixture was prepared according to directions given above, and, owing to its not being very thick on some trees, a number were resprayed the second day. The applications in both instances were made on bright, rather sunshiny days, though there was some wind in the afternoon. Rain commenced to fall in a slight drizzle Friday afternoon, the 28th, and during the night it rained very hard. An examination the following morning showed that very little of the mixture had been washed off.

An examination of these trees July 8 showed little that was decisive. A few scales were living, and the same was true of untreated trees, and therefore no definite conclusions could be drawn. Fruit buds appeared not to have been affected by the application, and the trees did not seem to be harmed in the slightest.

An examination Nov. 24 failed to give anything decisive with this material. The trees sprayed with this substance were in as good condition as those treated with the crude petroleum or the whale oil soap solution, but the difference was not marked enough to warrant the drawing of any conclusions unless it be that the

lime, salt and sulfur proved fully as effective as the other insecticides under these unsatisfactory conditions.

The results obtained with the lime, salt and sulfur mixture seem to indicate that, in order to be effective, the wash must not be exposed to drenching rains within three or four days after application. The exceedingly poor results following the application in the vicinity of Albany apparently show that this material is nearly worthless if the application be followed immediately by considerable rain. This instance certainly raises a strong doubt as to the value of this material when applied under such conditions. Should subsequent experiments prove this to be true, it will nearly disqualify this wash for use in our eastern climate, since such periods of immunity from rain can not be depended on in early spring, and the same is true to a lesser extent in the fall and during the winter.

Summary

Our experience during the past three years and that of many others with spring applications of crude petroleum emulsion has been so uniformly satisfactory that we are at loss to account for the poor results obtained by others. The many injuries to fruit trees and the dangerous nature of the material emphasize the necessity of caution and the grower, who would use crude petroleum is therefore advised to experiment on a small scale at first. The fall treatment came so near injuring the trees that we can not advise it. The application of this material in successive years has not caused the injury we feared but on the contrary the trees have grown rapidly and gained in vigor.

The whale oil soap is a valuable insecticide, particularly when applied in the fall though in doing this there is danger of injuring peach buds. A spring application, using only 1¼ lb to the gallon, if thorough, is a very effective check.

Our experience with lime, salt and sulfur has not been entirely satisfactory but the many excellent reports from other experimenters lead us to believe that possibly our results may have been exceptional and that this mixture may prove a most excellent material for controlling this scale insect, a point which can be determined only by further experimentation. It is, however, very disagreeable to handle, being hard on operator and apparatus.

VOLUNTARY ENTOMOLOGIC SERVICE OF NEW YORK STATE

The work of the last three years has been continued, and a number of observations have been added to previous records. The exceedingly unfavorable season, as noted on the preceding page, has interfered with the reception of the usual number of reports. Thirty voluntary observers were appointed during the season, and but 19 of them rendered reports. This is largely due to the general scarcity of injurious insects, which led a number of observers to conclude that there was comparatively little worthy of record. It will be noted that the following reports contain a considerable number of negative statements. These are of value as emphasizing observations on the marked scarcity of different species. The almost universal comments on cold, unseasonable weather seem to warrant the conclusion that the relative absence of insect life was due to adverse climatic conditions.

Summaries of reports from voluntary observers

The scientific names, or other matter, inserted in brackets indicate determinations or information supplied by the entomologist, and the other names are presumably correct except where questioned. The date given after the record is that of the writing of the record, except in a few instances where this was absent, and the date of reception was inserted. The latter is from one to two days later than that of the original record.

Cattaraugus county (C. E. Eldredge, Leon)—Appletree tent caterpillars [Clisiocampa americana Fabr.] appeared May 23, and the appletree bark louse [Mytilaspis pomorum Bouché] is quite abundant on some trees. A few years ago bumblebees were very abundant in this section, but now we seldom see them. May 28. Colorado potato beetles [Doryphora 10-lineata Say] appeared May 31. The looper caterpillar has been very abundant on beech and mapletrees. A few specimens of the cottony mapletree scale insect [Pulvinaria innumerabilis Rathv.] have appeared on maples, and another scale (Lecanium ? quercitronis) was found on ironwood leaves that had withered on the branch. A specimen of the larva of Notolophus ? antiqua Linn. was found on

an appletree. Cankerworms have also appeared. June 11. The cottony mapletree scale insect has increased largely in numbers in the last few weeks. Colorado potato beetles are doing very little damage this summer. This is probably due to the excessive wet weather, which has also prevented grasshopper eggs from hatching. Only three or four nests of the appletree tent caterpillar have been met with. Flies are quite numerous on cattle [probably the horn fly ? Haematobia serrata Robs. Desv.], and the wet weather does not seem to affect them much. The codling moth [Carpocapsa pomonella Linn.] has damaged the apple crop to quite an extent. July 22. Fall webworms [Hyphantria textor Harris] appeared on our apple and forest trees the last week of July. Grasshoppers are quite abundant in some sections, and squash bugs are not as numerous as last year. The excessive wet weather has prevented serious injuries by grasshoppers, though they have worked on heads of grain to a considerable extent. Aug. 12.

Chemung county (M. H. Beckwith, Elmira)—The currant sawfly [Pteronus ribesii Scop.] appeared on gooseberries May 2, though not in such large numbers as usual. Appletree tent-caterpillars [Clisiocampa americana Fabr.] are very abundant again this season. Colorado potato beetles [Doryphora 10-lineata Say] are not found in any numbers at the present date. The excessively cold weather appears to be holding insects in check to a great extent. May 28. The second brood of the currant sawfly has appeared on the leaves, though it is not usually found till the fruit is nearly ripe. Cutworms are very abundant in tobacco fields and are necessitating a large amount of resetting of plants where they have been destroyed. June 16. Potato beetles are not so abundant as last year, and the larvae or grubs appear to have been held in check by the unusually cold, wet weather. The same appears to have been true of most of our destructive insects, though grasshoppers are quite numerous in meadows and pastures. July 17.

Dutchess county (H. D. Lewis, Annandale)—Injurious insects have been unusually scarce up to date. Colorado potato beetles [Doryphora 10-lineata Say] are present in small numbers, and no elm leaf beetles [Galerucella luteola Müll.] have

been observed where in former years trees were defoliated by them. Though the forest tent caterpillars [Clisiocampa disstria Hübn.] have been numerous, they have not been so abundant as last year, and they are now in the pupa or cocoon stage. Some maples have been badly defoliated by this pest. June 20. Aside from the forest tent caterpillar, we have been remarkably free from insect pests. These caterpillars have inflicted considerable damage on hard maples, our principal shade trees. June 23. A few elm leaf beetles have made their appearance, though but little damage has been caused. The extremely wet weather has kept insects pretty well in check. Potato beetles have been scarce and easily controlled. July 18.

Erie county (J. U. Metz, Swormville)—Asparagus beetles [Crioceris asparagi Linn.] have been exceedingly numerous this spring and much more abundant than in former years. No currant worms [Pteronus ribesii Scop.] have appeared so far and few potato beetles. A very little Hessian fly [Cecidomyia destructor Say] has been observed in a neighboring wheat field. May 28. Hessian fly has been found only in very small numbers; probably less than 1% of wheat is infested. There appears to be no more of this pest on no. 6 wheat than on more resistant varieties. The bud moth [Tmetocera ocellana Schiff.] is scarce, and no indications of the palmer worm [Ypsolophus pometellus Harr.] have been observed. Not a single nest of the appletree tent caterpillar [Clisiocampa americana Fabr.] has been found. June 20.

Genesee county (J. F. Rose, South Byron)—The first asparagus beetle [Crioceris asparagi Linn.] was observed May 25, and the currant sawfly [Pteronus ribesii Scop.] had lopped young currant shoots by May 23. There is a little complaint of potato beetles [Doryphora 10-lineata Say] working on tomatoes. No injury by Hessian fly [Cecidomyia destructor Say] has been reported, and appletree tent caterpillars [Clisiocampa americana Fabr.] do not appear to be as abundant as last year. Currant worms are rarer. May 26. Appletree tent caterpillars are certainly much less numerous than last year. There are not nearly so many to be seen along the roadsides, and their scarcity in these places is attributed to the

mice girdling most of the wild cherries the previous winter. The young caterpillars, therefore, had nothing to feed on and died. May beetles [Lachnosterna species] are very numerous in the soil. June 2. Potato beetles are very abundant on early potatoes. But little damage has as yet been reported from the Hessian fly. There does not appear to be one appletree tent caterpillar this year where there were a hundred last year. The weather has been very cool and dry. The bud moth [Tmetocera ocellana Schiff.] has been very abundant and is apparently becoming more numerous each year. It is one of our worst fruit pests. June 10. Striped cucumber beetles [Diabrotica vittata Fabr.] were first observed June 14. There are yet no reports of injuries by the Hessian fly, and not a tree has been seen that was troubled by the forest tent caterpillar [Clisiocampa disstria Hübn.], even where the pest was abundant last year. June 16. The black squash bug, or stink bug [Anasa tristis DeGeer], appeared June 21. They are few as compared with the striped cucumber beetle. The very wet, cold weather appears to have delayed the appearance of many insect pests, including the Hessian fly. Even the white wheat, no. 6, that was so badly injured last year, is comparatively free from damage the present season. June 25. The first nests of the fall webworm [Hyphantria textor Harris] were observed July 22, and the spotted grapevine beetle [Pelidnota punctata Linn.] and the squash vine borer [Melittia satyriniformis Hübn.] had also appeared by that time. The striped cucumber beetle and the squash bug are much less abundant than last year. The green cabbage worms [Pieris rapae Linn.] are becoming quite numerous. Mosquitos were very scarce in this vicinity till last week. The Colorado potato beetle [Doryphora 10-lineata Say] has been as bad, if not worse, than ever before in some sections. Many growers have been obliged to resort to power sprayers in order to control the pest. July 28. The fall webworm is by far the most abundant I have ever seen it. A hairy caterpillar [Datana integerrima Gr. & Rob.] has defoliated some of the butternut and black walnut trees in this section. The squash bug is much less abundant than it has been for a number of years. Sep. 1.

Greene county (O. Q. Flint, Athens)—The forest tent caterpillar [Clisiocampa disstria Hübn.] appears to be carrying its destructive work eastward, leaving infested territory after two to four years' depredations. June 25.

Herkimer county (George S. Graves, Newport)—The currant sawfly [Pteronus ribesii Scop.] was observed on bushes May 23 and had evidently been feeding for about a week. Pistol case-bearers [Coleophora malivorella Riley] are abundant in some orchards, while the appletree tent caterpillar [Clisiocampa americana Fabr.] is relatively scarce as yet. The currant aphis [Myzus ribis Linn.] is not very plentiful, though it appeared shortly after the currant leaves. Bumblebees are very abundant this season. May 29. The Colorado potato beetle [Doryphora 10-lineata Say] appeared May 31, and farmers report it as being unusually abundant. Plantain leaves have been eaten by the same insect [probably Dibolia borealis Chev.], as for the last three years. The striped cucumber beetle [Diabrotica vittata Fabr.] was recently found on potato vines in my garden, and a neighbor reports a large number of them on his potatoes. The larvae of the elm flea beetle [Disonycha triangularis Say] appears to be quite injurious to elms throughout this section, and signs of their work were observed in the city of Utica. Grasshoppers are not very abundant as yet. June 12. The spiny elm caterpillar [Euvanessa antiopa Linn.] has been feeding on alders to a considerable extent. The eggs of the praying mantis [Mantis religiosa Linn.] appear to be hatching. June 22. The first grubs of the Colorado potato beetle were observed June 23. The forest tent caterpillar [Clisiocampa disstria Hübn.] is extremely rare, but one larva having been observed this year, though it is reported as being very abundant at Gravesville, 7 miles north. Grasshoppers are not numerous. The cold weather seems to have checked the development of many insects. The spiny elm caterpillars are devouring the foliage of wayside bushes. June 27. Rose beetles [Macrodactylus subspinosus Fabr.] have been and are still very destructive to plants in the local cemetery. Besides depredating on hydrangeas and rosebushes, they have nearly defoliated a large Virginia creeper and are now working on the lower leaves of a large elm tree.

They have also attacked geraniums in the cemetery and later cherry and plum trees to some extent. The foliage of one raspberry bush has been nearly destroyed by these pests. July 4. Rose beetles have been exceedingly destructive in this section and seem to attack almost everything in the vegetable line this season. The black headed cabbage worm [Evergestis stramenalis Hübn.] is causing much damage to turnips. Currant worms have again made their appearance and seem to be a fourth brood. Horn flies [Haematobia serrata Rob.-Desv.] are not so abundant as usual. Grasshoppers are eating potato vines seriously, while the Colorado potato beetle is somewhat scarce. July 21. Spittle insects were noticed on a small butternut tree in the woods July 17. Horn flies have been plentiful for about a week, and the large horseflies, usually so common during haying time, are just appearing, Aug. 1. The first nest of the fall webworm [Hyphantria textor Harris] was noticed on cherry Aug. 1. Rose beetles, though they have been very destructive to nearly every plant, have not eaten the small plants as they did last year. Caterpillars of the cabbage butterfly [Pieris rapae Linn.] have begun their depredations. Rainy weather continues to keep many destructive insects in check. Aug. 2. Caterpillars of the cabbage butterfly are more abundant than I have ever known them, while the adult insects are correspondingly scarce, having been seldom seen about the garden. Aug. 18. Cabbage butterflies were very numerous Aug. 21, and currant worms were noticed within a week on currant bushes. Sep. 16.

Livingston county (W. R. Houston, Geneseo)—Four lined leaf bugs [Poecilocapsus lineatus Fabr.] are now working on currants. This week has been very cold, and the temperature is between 36° and 40°, with snow flurries. May 28. Market gardeners in this vicinity are complaining of injuries by the cabbage root maggot [Phorbia brassicae Bouché], and they are afraid that the crop will be a short one. There was a heavy white frost on the 9th. Colorado potato beetles [Doryphora 10-lineata Say] are few, and so far no eggs have hatched. June 12.

Ontario county (J. J. Barden, Stanley)—Cutworms are very abundant and are doing a great deal of damage in newly set

cabbage fields. One farmer reports a loss of 6000 plants on three acres. The complaint is very general in this section. June 20. A webworm [?Tetralopha] is very abundant on maple, elm and other forest trees in the vicinity of Dansville, though not so numerous as last year. Sep. 20.

Orange county (J. M. Dolph, Port Jervis)—Very few injurious insects have appeared this year. Even plant lice are relatively scarce; and the appletree tent caterpillar [Clisiocampa americana Fabr.] has almost entirely disappeared. There has been comparative freedom from insect pests this year, which may possibly be attributed to the cold, wet weather. The average temperature in this section for July and August 1901 was 74.2° while the average for the same months this year was 69.2°, a decrease during the past season of 5°. Sep. 3.

Queens county (C. L. Allen, Floral Park)—Colorado potato beetles [Doryphora 10-lineata Say] have been conspicuous by their absence, and not one farmer in ten has had occasion to use paris green for the purpose of controlling them. Not a cabbage worm [Pieris rapae Linn.] has been seen. The heavy rains of April killed all the butterflies, and now we see only one or two. The season has been marked by an almost entire absence of the more common insect pests. Oct. 3.

Rensselaer county (W. C. Hitchcock, Pittstown)—The appletree tent caterpillars [Clisiocampa americana Fabr.] are abundant and very destructive, since the foliage is backward and their ravages are more apparent. They do not seem to have been injured in the slightest by the late frost. Plum curculio [Conotrachelus nenuphar Herbst.] pupae are unusually abundant in the soil about the trees. May 23. Asparagus beetles [Crioceris asparagi Linn.] are abundant. Apples are nearly all dropping on account of the worms. [Probably the codling moth larva, Carpocapsa pomonella Linn.] Aug. 13. One mantis [Mantis religiosa Linn.] was found nearly grown on Sep. 28, and a neighbor who saw it stated that she had observed several of them. Sep. 30.

Rockland county (S. B. Huested, Blauvelt)—The corn worm [Chelymorpha argus Licht.] appears to be doing considerable damage. The fall webworm [Hyphantria textor Harris] is quite plentiful in this section. Colorado potato beetles

[Doryphora 10-lineata Say] have not been so abundant as in former years, which is probably due to the cooler season. Plum curculios [Conotrachelus nenuphar Herbst.] are plenty, but not so prevalent as during some seasons. July 12.

Schoharie county (John F. Johnson, Breakabeen)—Currant worms [Pteronus ribesii Scop.] appeared May 20 and are quite abundant and destructive. The grubs of the May or June beetle are also numerous and somewhat injurious. No forest tent caterpillars [Clisiocampa disstria Hübn.] have been observed this season, and those belonging to the appletree species [Clisiocampa americana Fabr.] are spinning their cocoons. May. 30. Colorado potato beetles [Doryphora 10-lineata Say] appeared about June 1 and are quite abundant. A very few forest tent caterpillars were observed and they are now spinning their cocoons. June 15.

Suffolk county (Alexander Mair, Oakdale)—There are very few Colorado potato beetles [Doryphora 10-lineata Say] in Suffolk county this year. Locusts [? Cicada septendecim Linn.] are abundant, but appear to be doing no special injury. The San José scale [Aspidiotus perniciosus Comst.] is very bad in this section, and comparatively little is being done toward its control. There are too many remedies and faith in none. June 23.

Tompkins county (C. E. Chapman, Peruville)—Forest tent caterpillars [Clisiocampa disstria Hübn.] have damaged a few maple and apple trees. The striped cucumber beetle [Diabrotica vittata Fabr.] is present in marked numbers, and the Colorado potato beetles [Doryphora 10-lineata Say] are scarce for this time of year. Flea beetles [? Epitrix cucumeris Harris] are very abundant, completely riddling potatoes, red raspberries and other foliage. June 30. Cabbage worms [Pieris rapae Linn.] are abundant and easily killed with paris green and water. Potato beetles are not numerous, though white grubs are plenty in potato fields and newly set strawberry beds. There is an abundance of young grasshoppers. July 30.

Ulster county (George S. Clark, Milton)—Some plant lice [? Myzus cerasi Fabr.] have appeared on cherrytrees and the appletree tent caterpillar [Clisiocampa americana Fabr.]

has done considerable damage in this section. There are hundreds of its nests in defoliated wild cherry and appletrees. May 30. The grape leaf curler [probably the grapevine plume moth, Oxyptilus periscelidactylus Fitch] appeared May 25. Appletree tent caterpillars are very abundant and are making their cocoons in large numbers. There are very few leaf hoppers [?Typhlocyba] on grapes. Plant lice are increasing in numbers, and thrips are abundant on rosebushes. June 15. Comparatively few insects are causing injury at the present time. The black flea beetle [Epitrix cucumeris Harris] is doing considerable damage to tomato and potato vines. June 13. Nests of the fall webworm [Hyphantria textor Harris] have begun to appear, and there are a few plant lice on cherry-trees. July 3. The second brood of currant worms [Pteronus ribesii Scop.] has appeared on some unsprayed bushes. Fall webworms are increasing in numbers, and they can be seen in many trees. Colorado potato beetles [Doryphora 10-lineata Say] are causing some injury, though they are not very numerous. July 10. Leaf hoppers are very scarce on grapevines and rosebushes. The continuous wet, cold weather appears to have kept them in check. Only a few fall webworms are to be seen at the present time. July 31. Fall webworms are still present but not nearly so abundant as last year, there being not over one nest to 25 of last season. There are some cabbage worms [Pieris rapae Linn.], but, as cabbage is little grown in this section, not much damage has been done. Aug. 27.

Warren county (C. L. Williams, Glens Falls)—Strawberry sawflies [Monostegia ignota Nort.] are feeding to some extent on strawberry plants. June 5. There are no insects in this region causing special trouble. July 29.

Wyoming county (W. H. Roeper, Wyoming)—Cankerworms made their appearance May 22 and have caused very little damage as yet. Appletree tent caterpillars [Clisiocampa americana Fabr.] are scarce, and very few of the forest species [Clisiocampa disstria Hübn.] have been found. May 26. The weather has been cold and wet since Saturday, and there was a white frost Sunday night. This unseasonable weather appears to have kept insects pretty well in check, and there is comparatively little to report. June 10.

FAUNAL STUDIES

A detailed study of the distribution of insects in New York State, or, for that matter, in any section where there is some variety in climate and physical characteristics, is bound to result in some interesting discoveries regarding the factors limiting the presence of various species. This is a matter of considerable importance, since it has a practical application in enabling us to determine in a measure the limits beyond which some of our very destructive, introduced species can not spread. The collection of my assistant, Mr Young, listed below, has been made in an exceptionally rich locality, where there is more or less mingling of boreal and austral forms. Over 700 species are represented in the list, to which we expect large additions will be made in the future. It is published at this time, not only to make the data available, but also in the hopes that other entomologists in that locality may be encouraged to continue the work.

LIST OF COLEOPTERA TAKEN AT NEWPORT, HERKIMER CO. N. Y.

BY D. B. YOUNG

We have had lists from the western and southeastern parts of the State of New York and the Adirondacks, but none so far, to our knowledge, from the central portion of the State. The object of this list is threefold: partially to fill the gap, to call the attention of collectors and others to a much neglected field, and to show the result of five years' continuous collecting in a single restricted locality, restricted in that this section is almost destitute of pine, spruce, balsam and oak. Therefore, it will be noticed that many of the forms found about these trees, only a day's drive to the north, are absent from this list.

Our thanks are due to Mr Charles Liebeck of Philadelphia Pa. for his kindness in determining quite a large number of the beetles.

COLEOPTERA.

Cicindela 6–guttata *Fabr.*
C. purpurea *Oliv.*
C. vulgaris *Say*
C. repanda *Dej.*
Omophron tesselatum *Say*
Cychrus brevoorti *Lec.*
C. lecontei *Dej.*
Carabus maeander *Fisch.*
C. limbatus *Say*
Calosoma scrutator *Fabr.*
C. frigidum *Kirby*
C. calidum *Fabr.*
Elaphrus ruscarius *Say*
Dyschirius *sp.*
Clivina impressifrons *Lec.*
Schizogenius amphibius *Hald.*
Bembidium inaequale *Say*
B. nigrum *Say*
B. ustulatum *Linn.*
B. picipes *Kirby*
B. variegatum *Say*
B. intermedium *Kirby*
B. versicolor *Lec.*
B. quadrimaculatum *Linn.*
Tachys laevus *Say*
T. nanus *Gyll.*
T. flavicauda *Say*
T. tripunctatus *Say*
Patrobus longicornis *Say*
Pterostichus adoxus *Say*
P. rostratus *Newm.*
P. honestus *Say*
P. lucublandus *Say*
Amara fallax *Lec.*
A interstitialis *Dej.*
A. obesa *Say*
Dicaelus elongatus *Bon.*
Calathus gregarius *Say*
Platynus hypolithus *Say*
P. angustatus *Dej.*
P. sinuatus *Dej.*
P. melanarius *Dej.*
P. cupripennis *Say*
P. placidus *Say*
P. ruficornis *Lec.*
P. picipennis *Kirby*
Galerita janus *Fabr.*
Lebia grandis *Hentz.*
L. ornata *Say*
Lebia fuscata *Dej.*
L. scapularis *Dej.*
Apristus cordicollis *Leo.*
Cymindis pilosa *Say*
Brachynus fumans *Fabr.*
B. cordicollis *Dej.*
Chlaenius sericeus *Forst.*
C. tricolor *Dej.*
C. pennsylvanicus *Say*
Brachylobus lithophilus *Say*
Geopinus incrassatus *Dej*
Agonoderus pallipes *Fabr.*
A. partiarius *Say*
A. pauperculus *Dej.*
A. testaceus *Dej.*
Harpalus viridiaeneus *Beauv.*
H. caliginosus *Fabr.*
H. pennsylvanicus *De G.*
H. *var.* erythropus *Dej.*
H. herbivagus *Say*
Bradycellus rupestris *Say*
Anisodactylus nigerrimus *Dej.*
A. verticalis *Lec.*
Haliplus ruficollis *De G.*
Cnemidotus 12-punctatus *Say*
C. edentulus *Lec.*
Laccophilus maculosus *Germ.*
Bidessus affinis *Say*
Coelambus punctatus *Say*
Hydroporus modestus *Aubé*
Ilybius biguttalus *Germ.*
Copelatus glyphicus *Say*
Agabus obtusatus *Say*
Rhantus binotatus *Harris*
Colymbetes sculptilis *Harris*
Dytiscus fasciventris *Say*
D. verticalis *Say*
Acilius semisulcatus *Aubé*
A. fraternus *Harris*
Gyrinus ventralis *Kirby*
Dineutes assimilis *Aubé*
Helophorus lineatus *Say*
Hydrochus excavatus *Lec.*
H. subcupreus *Rand.*
Hydrophilus triangularis *Say*
H. nimbatus *Say*
H. glaber *Herbst*
Hydrocharis obtusatus *Say*
Berosus striatus *Say*

Laccobius agilis *Rand.*
Philhydrus ochraceus *Melsh.*
Hydrocombus fimbriatus *Melsh.*
Hydrobius globosus *Say*
H. fuscipes *Linn.*
H. digestus *Lec.*
Sphaeridium scarabaeoides *Linn.*
Cercyon praetextatum *Say*
C. unipunctatum *Linn.*
Cryptopleurum vagans *Lec.*
Necrophorus orbicollis *Say*
N. marginatus *Fabr.*
N. pustulatus *Hersch.*
N. vespilloides *Herbst*
N. tomentosus *Web.*
Silpha surinamensis *Fabr.*
S. lapponica *Herbst*
S. inaequalis *Fabr.*
S. noveboracensis *Forst.*
S. americana *Linn.*
Choleva luridipennis *Mann.*
C. simplex *Say*
C. clavicornis *Lec.*
C. terminans *Lec.*
Prionochaeta opaca *Say*
Anisotoma collaris *Lec.*
Colenis impunctata *Lec.*
Liodes globosa *Lec.*
L. basalis *Lec.*
Agathidium oniscoides *Beauv.*
A. politum *Lec.*
Tmesiphorus carinatus *Say*
Tyrus humeralis *Aubé*
Falagria cingulata *Lec.*
Aleochara lata *Grav.*
A. bimaculata *Grav.*
Gyrophaena affinis *Fauv.*
Quedius fulgidus *Fabr.*
Q. capucinus *Grav.*
Listotrophus cingulatus *Grav.*
L. capitatus *Bland.*
Creophilus villosus *Grav.*
Staphylinus maculosus *Grav*
S. violaceus *Grav.*
Ocypus ater *Grav.*
Philonthus aeneus *Rossi*
P. lomatus *Er.*
P. brunneus *Grav.*
P. cyanipennis *Fabr.*
P. blandus *Grav.*
Actobius sobrinus *Er.*
A. paederoides *Lec.*
A. terminalis *Lec.*
Xantholinus cephalus *Say*
Leptolinus rubripennis *Lec.*
Stenus bipunctatus *Er.*
S. juno *Fabr.*
S. stygicus *Say*
S. parallelus *Casey*
S. flavicornis *Er.*
S. canadensis *Casey*
S. punctatus *Er.*
Cryptobium bicolor *Grav.*
C. pallipes *Grav.*
Lathrobium punctulatum *Lec.*
L. bicolor *Lec.*
L. collare *Er.*
Paederus littorarius *Grav.*
Sunius longiusculus *Mann.*
Tachinus memnonius *Grav.*
T. addendus *Horn*
T. flavipennis *Dej.*
T. fimbriatus *Grav.*
T. picipes *Er.*
T. limbatus *Melsh.*
Tachyporus maculipennis *Lec.*
T. jocosus *Say*
T. chrysomelinus *Linn.*
Conosoma littoreum *Linn.*
C. crassum *Grav.*
C. pubescens *Payk.*
C. basale *Er.*
C. scriptum *Horn*
Boletobius niger *Grav.*
B. cingulatus *Mann.*
B. cincticollis *Say*
B. anticus *Horn*
B. trinotatus *Er.*
B. cinctus *Grav.*
B. quaesitor *Horn*
Mycetoporus americanus *Er.*
Oxyporus femoralis *Grav.*
O. lateralis *Grav.*
O. 5-maculatus *Lec.*
Oxytelus sculptus *Grav.*
O. rugosus *Grav.*
O. fuscipennis *Mann.*
Anthobium convexum *Fauv.*
Glyptoma costale *Er.*
Siagonium punctatum *Lec.*

Actidium *sp.*
Ptenidium *sp.*
Trichopteryx haldemanni *Lec.*
Scaphidium quadriguttatum *Say*
Scaphisoma convexum *Say*
Olibrus consimilis *Marsh*
Sacium fasciatum *Say*
Megilla maculata *De G.*
Hippodamia glacialis *Fabr.*
H. convergens *Guér.*
H. 13-punctata *Linn.*
H. parenthesis *Say*
Coccinella trifasciata *Linn.*
C. 9-notata *Herbst*
C. transversoguttata *Fabr.*
C. *var.* californica *Mann.*
C. sanguinea *Linn.*
Adalia bipunctata *Linn.*
Anatis 15-punctata *Oliv.*
Psyllobora 20-maculata *Say*
Chilocorus bivulnerus *Muls.*
Brachyacantha ursina *Fabr.*
B. *var.* 10-pustulata *Melsh.*
B. 4-punctata *Melsh.*
Hyperaspis undulata *Say*
H. signata *Oliv.*
Scymnus collaris *Melsh.*
S. tenebrosus *Muls.*
Rhanis unicolor *Ziegl.*
Phymaphora pulchella *Newm.*
Aphorista vittata *Fabr.*
Mycetina perpulchra *Newm.*
Endomychus biguttatus *Say*
Languria mozardi *Lat.*
L. gracilis *Newm.*
Dacne maculata *Say*
Megalodacne fasciata *Fabr.*
M. heros *Say*
Mycotretus sanguinipennis *Say*
M. pulchra *Say*
Tritoma festiva *Lec.*
T. macra *Lec.*
T. thoracica *Say*
Synchita fuliginosa *Melsh.*
Ditoma quadriguttata *Say*
Cerylon castaneum *Say*
Philothermus glabriculus *Lec.*
Rhyssodes exaratus *Ill.*
Silvanus surinamensis *Linn.*
S. bidentatus *Fabr.*
Silvanus imbellis *Lec.*
S. advena *Waltl.*
Catogenus rufus *Fabr.*
Cucujus clavipes *Fabr.*
Laemophlaeus biguttatus *Say*
L. fasciatus *Melsh.*
L. modestus *Say*
L. convexulus *Lec.*
L. adustus *Lec.*
L. testaceus *Fabr.*
Dendrophagus glaber *Lec.*
Uliota dubius *Fabr.*
Atomaria ochracea *Zimm.*
A. ephippiata *Zimm.*
Ephistemus apicalis *Lec.*
Mycetophagus punctatus *Say*
M. flexuosus *Say*
M. bipustulatus *Melsh.*
M. pluripunctatus *Lec.*
M. obsoletus *Melsh.*
Tryphyllus humeralis *Kirby*
Typhoea fumata *Linn.*
Byturus unicolor *Say*
Dermestes caninus *Germ.*
D. lardarius *Linn.*
D. vulpinus *Fabr.*
Attagenus piceus *Oliv.*
Trogoderma ornatum *Say*
T. tarsale *Melsh.*
Anthrenus scrophulariae *Linn.*
A. varius *Fabr.*
A. musaeorum *Linn.*
Hister interruptus *Beauv.*
H. americanus *Payk.*
H. lecontei *Mars.*
H. gracilis *Lec.*
Epierus regularis *Beauv.*
Saprinus rotundatus *Kug.*
S. assimilis *Payk.*
S. fraternus *Say*
S. patruelis *Lec.*
Plegaderus transversus *Say*
Bacanius punctiformis *Lec.*
Brachypterus urticae *Fabr.*
Cercus abdominalis *Er.*
C. pennatus *Murr.*
Carpophilus niger *Say*
C. brachypterus *Say*
Colastus truncatus *Rand.*
Conotelus obscurus *Er.*

Epuraea rufa *Say*
Nitidula bipustulata *Linn.*
N. rufipes *Linn.*
Phenolia grossa *Fabr.*
Omosita colon *Linn.*
Thalycra concolor *Lec.*
Perthalycra murrayi *Horn*
Orthopeplus quadricollis *Horn*
Cychramus adustus *Er.*
Cryptarcha ampla *Er.*
Ips quadriguttata *Fabr.*
I. sanguinolentus *Oliv.*
I. confluentus *Say*
I. vittatus *Say*
Rhizophagus dimidiatus *Mann.*
R. bipunctatus *Say*
R. remotus *Lec.*
Latridius minutus *Linn.*
Corticaria grossa *Lec.*
Tenebrioides corticalis *Melsh.*
T. castanea *Melsh.*
Peltis pippingskoeldi *Mann.*
Calitys scabra *Thunb.*
Grynocharis 4-lineata *Melsh.*
Thymalus fulgidus *Er.*
Bactridium ephippigerum *Guér.*
B. striolatum *Reit.*
B. cavicolle *Horn*
Cytilus sericeus *Forst.*
Heterocerus fatuus *Kies.*
Ptilodactyla serricollis *Say*
Ectopria nervosa *Melsh.*
Prionocyphon discoideus *Say*
Cyphon obscurus *Guér.*
C. collaris *Guér.*
C. variabilis *Thunb.*
Tharops ruficornis *Say*
Deltometopus amoenicornis *Say*
Dromaeolus cylindricollis *Say*
D. striatus *Lec.*
Fornax orchesides *Newm.*
Microrrhagus humeralis *Say*
M. pectinatus *Lec.*
Epiphanis cornutus *Esch.*
Adelocera marmorata *Fabr.*
A. aurorata *Lec.*
A. brevicornis *Lec.*
Alaus oculatus *Linn.*
Cryptohypnus planatus *Lec.*
C. abbreviatus *Say*
Cryptohypnus bicolor *Esch.*
C. tumescens *Lec.*
C. pectoralis *Say*
C. *var.* inops *Lec.*
C. melsheimeri *Horn*
Elater hepaticus *Melsh.*
E. pedalis *Germ.*
E. nigricollis *Herbst*
E. linteus *Say*
E. vitiosus *Lec.*
E. semicinctus *Rand.*
E. obliquus *Say*
Drasterius elegans *Fabr.*
Agriotes mancus *Say*
A. fucosus *Lec.*
Dolopius lateralis *Esch.*
Melanotus castanipes *Payk.*
M. fissilis *Say*
M. communis *Gyll.*
Limonius plebejus *Say*
Campylus denticornis *Kirby*
Pityobius anguinus *Lec.*
Athous cucullatus *Say*
A. rufifrons *Rand.*
Sericosomus silaceus *Say*
Corymbites vernalis *Hentz.*
C. cylindriformis *Herbst*
C. spinosus *Lec.*
C. sulcicollis *Say*
C. hamatus *Say*
C. hieroglyphicus *Say*
C. cruciatus *Linn.*
Asaphes decoloratus *Say*
A. memnonius *Herbst*
Throscus constrictor *Say*
T. convergens *Horn*
Dicerca divaricata *Say*
D. obscura *Fabr.*
D. *var.* lurida *Fabr.*
Buprestis maculiventris *Say*
Melanophila longipes *Say*
M. fulvoguttata *Harris*
Anthaxia viridicornis *Say*
Chrysobothris femorata *Fabr.*
Agrilus ruficollis *Fabr.*
A. otiosus *Say*
A. bilineatus *Web.*
Agrilus politus *Say*
Brachys ovata *Web.*

Brachys aerosa *Melsh.*
Calopteron reticulatum *Fabr.*
Celetes basalis *Lec.*
Caenia dimidiata *Fabr.*
Lopheros fraternus *Rand.*
Eros thoracicus *Rand.*
E. aurora *Herbst*
E. sculptilis *Say*
E. crenatus *Germ.*
Plateros canaliculatus *Say*
P. lictor *Newm.*
Polyclasis bifaria *Say*
Lucidota atra *Fabr.*
L. punctata *Lec.*
Ellychnia corrusca *Linn.*
Pyropyga fenestralis *Melsh.*
P. decipiens *Harris*
Pyractomena lucifera *Melsh.*
Photinus ardens *Lec.*
P. scintillans *Say*
Photuris pennsylvanica *De G.*
Chauliognathus pennsylvanicus *De G.*
Podabrus tricostatus *Say*
P. rugulosus *Lec.*
P. basilaris *Say*
P. comes *Lec.*
P. punctatus *Lec.*
P. pattoni *Lec.*
Telephorus dentiger *Lec.*
T. excavatus *Lec.*
T. carolinus *Fabr.*
T. lineola *Fabr.*
T. scitulus *Say*
T. rectus *Melsh.*
T. pusillus *Lec.*
T. rotundicollis *Say*
T. tuberculatus *Lec.*
T. bilineatus *Say*
Ditemnus bidentatus *Say*
Malthodes arcifer *Lec.*
M. fuliginosus *Lec.*
Collops 4-maculatus *Fabr.*
Cymatodera bicolor *Say*
Clerus quadriguttatus *Oliv.*
Thaneroclerus sanguineus *Say*
Hydnocera longicollis *Ziegl.*
Necrobia violaceus *Linn.*
Ptinus fur *Linn.*
P. quadrimaculatus *Melsh.*
Trypopitys sericeus *Say*
Ptilinus ruficornis *Say*
Endecatomus rugosus *Rand.*
Cupes concolor *Westw.*
C. capitata *Fabr.*
Cis fuscipes *Mellié*
Ennearthron thoracicornis *Ziegl.*
Ceracis sallei *Mellié*
Dorcus parallelus *Say*
Platycerus quercus *Web.*
Ceruchus piceus *Web.*
Passalus cornutus *Fabr.*
Copris anaglypticus *Say*
Onthophagus hecate *Panz.*
Aegialia rufa *Lec.*
Ataenius gracilis *Melsh.*
A. cognatus *Lec.*
Dialytes striatulus *Say*
Aphodius fossor *Linn.*
A. fimetarius *Linn.*
A. granarius *Linn.*
A. inquinatus *Herbst*
A. stercorosus *Melsh.*
A. prodromus *Brahm.*
A. walshii *Horn*
Bolboceras lazarus *Fabr.*
Odontaeus cornigerus *Melsh.*
Geotrupes splendidus *Fabr.*
G. egeriei *Germ.*
G. balyi *Jek.*
Trox suberosus *Fabr.*
T. tuberculatus *De G.*
T. scaber *Linn.*
Dichelonycha elongata *Fabr.*
D. testacea *Kirby*
Serica vespertina *Gyll.*
S. sericea *Ill.*
Macrodactylus subspinosus *Fabr.*
Lachnosterna fusca *Fröhl.*
Pelidnota punctata *Linn.*
Euphoria inda *Linn.*
Cremastochilus canaliculatus *Kirby*
Osmoderma eremicola *Knoch.*
O. scabra *Beauv.*
Trichius affinis *Gory*
T. viridulus *Fabr.*
Parandra brunnea *Fabr.*
Orthosoma brunneum *Forst.*
Prionus laticollis *Drury*
Tetropium cinnamopterum *Kirby*
Phymatodes variabilis *Fabr.*

Phymatodes infuscatus *Lec.*
P. dimidiatus *Kirby*
Callidium janthinum *Lec.*
Tylonotus bimaculatus *Hald.*
Molorchus bimaculatus *Say*
Plagionotus speciosus *Say*
Neoclytus erythrocephalus *Fabr.*
Clytanthus ruricola *Oliv.*
Cyrtophorus verrucosus *Oliv.*
Euderces picipes *Fabr.*
Desmocerus palliatus *Forst.*
Encyclops caeruleus *Say*
Centrodera decolorata *Harris*
Pachyta monticola *Rand.*
Anthophilax malachiticus *Lec.*
A. attenuatus *Hald.*
Acmaeops directa *Newm.*
Gaurotes cyanipennis *Say*
Typocerus velutinus *Oliv.*
Leptura lineola *Say*
L. haematites *Newm.*
L. exigua *Newm.*
L. canadensis *Fabr.*
L. proxima *Say*
L. vittata *Germ.*
L. pubera *Say*
L. sphaericollis *Say*
L. vibex *Newm.*
L. aurata *Horn.*
L. mutabilis *Newm.*
Acanthoderes quadrigibbus *Say*
Leptostylus macula *Say*
Liopus alpha *Say*
Lepturges symmetricus *Hald.*
L. querci *Fitch*
Hyperplatys maculatus *Hald.*
Urographis fasciatus *De G.*
Pogonocherus mixtus *Hald.*
Saperda calcarata *Say*
S. vestita *Say*
S. tridentata *Oliv.*
Oberea bimaculata *Oliv.*
O. tripunctata *Swed.*
Tetraopes tetraophthalmus *Forst.*
Amphionycha flammata *Newm.*
Donacia rufa *Lec.*
Orsodachna atra *Ahr.*
Zeugophora varians *Cr.*
Syneta ferruginea *Germ.*
Lema trilineata *Oliv.*
Exema *sp.*
Bassareus mammifer *Newm.*
Cryptocephalus quadruplex *Newm.*
C. *var.* 4-guttulus *Suffr.*
C. mutabilis *Melsh.*
Pachybrachys litigiosus *Suffr.*
P. trinotatus *Melsh.*
P. intricatus *Suffr.*
Monachus saponatus *Fabr.*
Diachus auratus *Fabr.*
Xanthonia 10-notata *Say*
X. villosula *Melsh.*
Chrysochus auratus *Fabr.*
Typophorus canellus *Fabr.*
T. *var.* aterrimus *Oliv.*
T. *var.* thoracicus *Melsh.*
T. *var.* 6-notatus *Say*
Graphops pubescens *Melsh.*
Nodonota brunnea *Fabr.*
N. tristis *Oliv.*
Prasocuris vittata *Oliv.*
Doryphora clivicollis *Kirby*
D. 10-lineata *Say*
Chrysomela similis *Rog.*
C. praecelsis *Rog.*
C. elegans *Oliv.*
C. scalaris *Lec.*
C. philadelphica *Linn.*
C. *var.* spiraeae *Say*
C. multipunctata *Say*
Plagiodera viridis *Melsh.*
Gastroidea polygoni *Linn.*
Lina tremulae *Fabr.*
Cerotoma trifurcata *Forst.*
Phyllobrotica discoidea *Fabr.*
Luperus meraca *Say*
Diabrotica 12-punctata *Oliv.*
D. vittata *Fabr.*
D. longicornis *Say*
Trirhabda tomentosa *Linn. var.* canadensis *Kirby*
Galeruca decora *Say*
Oedionychis vians *Ill.*
O. quercata *Fabr. var.* limbalis *Melsh.*
Disonycha pennsylvanica *Ill.*
D. triangularis *Say*
D. xanthomelaena *Dalm.*
Haltica ignita *Ill.*
Crepidodera helxines *Linn.*
C. cucumeris *Harris*

Orthaltica copalina *Fabr.*
Systena hudsonias *Forst.*
S. marginalis *Ill.*
Phyllotreta vittata *Fabr.*
P. bipustulata *Fabr.*
P. chalybeipennis *Cr.*
Dibolia borealis *Chev.*
Psylliodes punctulata *Melsh.*
Odontota nervosa *Panz.*
Coptocycla aurichalcea *Fabr.*
Chelymorpha argus *Licht.*
Bruchus pisi *Linn.*
Phellopsis obcordata *Kirby*
Nyctobates pennsylvanica *De G.*
Iphthimus opacus *Lec.*
Upis ceramboides *Linn.*
Haplandrus femoratus *Fabr.*
Scotobates calcaratus *Fabr.*
Xylopinus saperdioides *Oliv.*
Tenebrio molitor *Linn.*
T. tenebrioides *Beauv.*
Tribolium ferrugineum *Fabr.*
Uloma impressa *Melsh.*
Diaperis hydni *Fabr.*
Platydema excavatum *Say*
P. ruficorne *Sturm.*
P. flavipes *Fabr.*
P. americanum *Lap.*
Boletotherus bifurcus *Fabr.*
Boletophagus corticola *Say*
B. depressus *Rand.*
Cistela sericea *Say*
Mycetochares binotata *Say*
M. nigerrima *Casey*
Capnochroa fuliginosa *Melsh.*
Arthromacra aenea *Say*
Penthe obliquata *Fabr.*
P. pimelia *Fabr.*
Synchroa punctata *Newm.*
Prothalpia undata *Lec.*
Melandrya striata *Say*
Hypulus simulator *Newm.*
Dircaea liturata *Lec.*
Anisoxya glaucula *Lec.*
Eustrophus tomentosus *Say*
E. repandus *Horn*
Holostrophus bifasciatus *Say*
Hallomenus scapularis *Melsh.*
H. debilis *Lec.*
Orchesia castanea *Melsh.*
Orchesia gracilis *Melsh.*
Canifa pallipes *Melsh.*
Rhinosimus viridiaeneus *Rand*
Asclera ruficollis *Say*
A. puncticollis *Say*
Anaspis nigra *Hald.*
A. flavipennis *Hald.*
A. rufa *Say*
Tomoxia bidentata *Say*
Mordella borealis *Lec.*
M. melaena *Germ.*
M. marginata *Melsh.*
Mordellistena biplagiata *Helm.*
M. atriceps *Smith*
M. comata *Lec.*
M. aspersa *Melsh.*
M. pustulata *Melsh.*
M. convicta *Lec.*
Corphyra newmani *Lec.*
C. lugubris *Say*
C. collaris *Say*
Notoxus anchora *Say*
Anthicus rejectus *Lec.*
Pyrochroa flabellata *Fabr.*
Schizotus cervicalis *Newm.*
Dendroides canadensis *Lat.*
D. concolor *Newm.*
Meloe angusticollis *Say*
Pomphopoea sayi *Lec.*
Hormorus undulatus *Uhl.*
Cyphomimus dorsalis *Horn*
Sitones hispidulus *Germ.*
S. flavescens *Marsh*
S. tibialis *Herbst*
Ithycerus noveboracensis *Forst.*
Apion rostrum *Say*
Phytonomus punctatus *Fabr.*
P. nigrirostris *Fabr.*
Hylobius confusus *Kirby*
Bagous obliquus *Lec.*
Magdalis barbita *Say*
M. pandura *Say*
M. armicollis *Say*
Anthonomus signatus *Say*
A. rufipennis *Lec.*
A. corvulus *Lec.*
A. crataegi *Walsh*
A. canus *Lec.*
Orchestes pallicornis *Say*
O. niger *Horn*

Orchestes ephippiatus *Say*
Piazorhinus scutellaris *Say*
Gymnetron teter *Fabr.*
Conotrachelus juglandis *Lec.*
C. nenuphar *Herbst*
C. anaglypticus *Say*
Tyloderma aereum *Say*
Cryptorhynchus parochus *Herbst*
Piazurus oculatus *Say*
Coeliodes curtus *Say*
Acoptus suturalis *Lec.*
Ceutorhynchus affluentus *Dietz*
C. sulcipennis *Lec.*
C. semirufus *Lec.*
C. septentrionalis *Gyll.*
Pelenomus sulcicollis *Fabr.*
Rhinoncus pyrrhopus *Lec.*
Baris strenua *Lec.*
Aulobaris naso *Lec.*
Sphenophorus sculptilis *Uhl.*
Calandra granaria *Linn.*
Cossonus platalea *Say*
Stenocelis brevis *Boh.*
Monorthrum mali *Fitch*
Pityophthorus minutissimus *Zimm.*
Xyloterus bivittatus *Kirby*
X. politus *Say*
Xyleborus obesus *Lec.*
Hylesinus aculeatus *Say*
H. opaculus *Lec.*
Eurymycter fasciatus *Oliv.*
Cratoparis lunatus *Fabr.*

LIST OF PUBLICATIONS OF THE ENTOMOLOGIST

The following is a list of the principal publications of the entomologist during the year 1902. 64 are given with the title,[1] place and time of publication and a summary of the contents of each. Volume and page number 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. 66: 842[27] means vol. 66, p. 842, column 2, beginning in the seventh ninth, i. e. about seven ninths of the way down.

Hackberry Gall (Country Gentleman, Oct. 17, 1901, 66:842[27])

The gall of Pachypsylla celtidis-mamma Riley, from Greenwich R. I., is briefly described and the insect characterized.

Dying White Pines (Troy Budget, Oct. 27, 1901, p.12; Argus [Albany] Nov. 17, p.13)

An account of injuries to white pines in the Hudson river valley by Tomicus calligraphus Germ., and associated species.

Seventeen Year Cicada (Country Gentleman, Nov. 7, 1901, 66:902[23])

Gives distribution of brood of Cicada septendecim Linn. to appear in 1902 and indorses advice to refrain from setting young trees or close pruning in sections where the insect is abundant.

Cigar Case-bearer (Country Gentleman, Nov. 7, 1901, 66:902[38])

The cases are described and the habits of Coleophora fletcherella Fern. given.

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

Katydid Eggs (Country Gentleman, Nov. 14, 1901, 66:922[22])

Identifies and describes the oviposition of Microcentrum retinervis Burm.

Scale Insects of Importance and List of the Species in New York State (N. Y. State Mus. Bul. 46. June 1901 [issued Nov. 15]. 94p., 15 plates [seven colored])

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San José Scale (Worcester [Mass.] Sunday Telegram, Nov. 17, 1901, p.7)

Summary account of Aspidiotus perniciosus Comst.

[1]A general account and bibliography of each is given.

Aquatic Insects of the Adirondacks. A study conducted at the entomologic field station, Saranac Inn N. Y., under the direction of the state entomologist, by James G. Needham Ph.D. and Cornelius Betten M.A. (N. Y. State Mus. Bul. 47. Sep. 1901 [issued Nov. 18]. 234p. 36 plates [six colored])

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Entomology and Entomologists in New York State (Argus [Albany] Dec. 3, 1901, p.5)

Abstract of annual address delivered before the Entomological Society of Albany.

Slaking Lime (Country Gentleman, Jan. 2, 1902, 67:6[35])

Slaking and kind of lime to be used for bordeaux mixture.

Elm Leaf Beetle (Troy Budget, Jan. 12, 1902, p.6; Argus [Albany] Feb. 2, p.12)

Injuries, distribution and means of controlling Galerucella luteola Müll. The work of the Laurel Hill Association of Stockbridge Mass. mentioned.

Insects Injurious to Elm Trees (Commissioners of Fisheries, Game and Forest. 5th Rep't, 1900 [rec'd Jan. 16, 1902] p.351–79; separate, issued Mar. 17, 1902)

Directions are given for the use of insecticides and the following species are noticed briefly: Elm leaf beetle, Galerucella luteola Müll.; bag or basket worm, Thyridopteryx ephemeraeformis Haw.; fall webworm, Hyphantria cunea Drury; spiny elm caterpillar, Euvanessa antiopa Linn., elm borer, Saperda tridentata Oliv. and elm bark louse, Gossyparia ulmi Geoff.

Two New Species of Ophion (Psyche, Feb. 1902, 9:307–8)

Technical descriptions of Ophion arcuatum and O. appendiculatum, n. sp.

Further Notes on Crude Petroleum and Other Insecticides (U. S. Dep't Agric. div. ent. Bul.31. n. s. 1902. p.49–51)

Results obtained with crude petroleum, whale oil soap, etc.

The Hessian Fly in New York State in 1901 (U. S. Dep't Agric. div. ent. Bul. 31. n. s. 1902. p.22–24)

Prevalence, damage and observations on broods of Cecidomyia destructor Say.

Observations on Forest and Shade Tree Insects in New York State (U. S. Dep't Agric. div. ent. Bul. 31. n. s. 1902. p. 63–68)

Notes on the following: Anisota senatoria Abb. & Sm., Cacoecia argyrospila Walk., Chalcophora virginiensis Drury, C. liberta Germ., Anomala lucicola Fabr., Monohammus scutellatus Say, M. titillator Fabr., M. confusor Kirby, Glyptocelis hirtus Oliv. [pubescens Fabr.], Pissodes strobi Peck, Magdalis lecontei Horn, M. alutacea Lec., Dendroctonus terebrans Oliv., Tomicus calligraphus Germ., T. cacographus Lec., T. pini Say, T. balsameus Lec., Xylotrechus sagittatus Germ., Galerucella luteola Müll., Clisiocampa disstria Hübn., Prionoxystus robiniae Peck, Lecanium nigrofasciatum Perg., Pseudococcus aceris Geoff. [Phenacoccus acericola King], and Chermes pinicorticis Fitch.

Ladybugs and Carpet Beetles (Country Gentleman, Feb. 13, 1902, 67:133[31])

Two spotted ladybug, Adalia bipunctata Linn., is characterized, and the Buffalo carpet beetle, Anthrenus scrophulariae Linn., and the black carpet beetle, Attagenus piceus Oliv., are briefly described and remedial measures given.

Soft Scale on Fern (Country Gentleman, Feb. 13, 1902, 67:133[42])

Lecanium hesperidum Linn. is briefly described, and the use of Ivory soap, a 5 cent cake to 8 gallons of water, advised.

Report of the Committee on Insects of the Eastern New York Horticultural Society (Eastern N. Y. Hortic. Soc. Proc. 5th annual meeting, 1901 [issued Feb. 1902] p.20–26)

Gipsy moth, Porthetria dispar Linn., fruit tree bark beetle, Scolytus rugulosus Ratz., palmer worm, Ypsolophus pometellus Harris, and the forest tent caterpillar, Clisiocampa disstria Hübn., were noticed in particular. The results obtained with kerosene, whale oil soaps and crude petroleum in various combinations are given briefly.

School Children and San José Scale (Worcester [Mass.] Evening Gazette, Feb. 17, 1902, p.3)

Letter advising the enlistment of school children as aids in detecting the San José scale, Aspidiotus perniciosus Comst., about Worcester Mass.

Hickory Bark Borer (Livingston Democrat [Geneseo N. Y.] Feb. 26, 1902, p.3)

Injuries of Scolytus 4-spinosus Say in the Genesee valley, earlier outbreaks, natural history and remedies.

Forest Tent Caterpillar (Country Gentleman, Mar. 6, 1902, 67:196[6]–97[2])

Remedial measures against Clisiocampa disstria Hübn.

Spraying for Cicada (Country Gentleman, Mar. 13, 1902, 67:219[15])

Spraying recently emerged cicadas, Cicada septendecim Linn., with a contact insecticide is advisable only in limited areas.

San José Scale Investigations (Country Gentleman, Mar. 13, 1902, 67:221[21])

Criticism of results on Aspidiotus perniciosus Comst., obtained by Professors Lowe and Parrott. *See* N.Y. Agric. Exp. Sta. Bul. 202.

Fumigation (Country Gentleman, Mar. 27, 1902, 67:262[25])

Value of hydrocyanic acid gas against bedbugs, Acanthia lectularia Linn., and hen lice.

Report on Insects for 1901, read before Eastern New York Horticultural Society Feb. 12, 1902 (Country Gentleman, Mar. 27, 1902, 67:265[21], 290[1]–91[9], 308[21])

The following insects were noticed: giant swallowtail, Heraclides cresphontes Cram., cicada-killer, Sphecius speciosus Drury, Hessian fly, Cecidomyia destructor Say, squash bug, Anasa tristis DeGeer. The value of trap lanterns was commented on, and the results obtained by the use of various insecticides against the San José scale were given. The fruit tree bark beetle, Scolytus rugulosus Ratz., the hickory bark borer, Scolytus 4-spinosus Say, the roundheaded appletree borer, Saperda candida Fabr., the elm leaf beetle, Galerucella luteola Müll., the grapevine Fidia, Fidia viticida Walsh, the peach twig moth, Anarsia lineatella Zell., Cenopis diluticostana Wlsm., and the carrot rust fly, Psila rosae Linn., were also noticed.

Bark Louse (Country Gentlemen, Ap. 10, 1902, 67:306[44])

Remedies for Mytilaspis pomorum Bouché.

White Scale (Country Gentleman, Ap. 17, 1902, 67:329[15])

Remedies for Aspidiotus hederae Vall.

Insect Enemies to Shade Trees (Col. State Board Hortic. Rep't, 1901. 1902 [rec'd Ap. 22] 13:164–70)

Some general considerations in preventing insect depredations with brief notices of the following species: Gipsy moth, Porthetria dispar Linn., leopard moth, Zeuzera pyrina Linn., white marked tussock moth, Notolophus leucostigma Abb. & Sm., spiny elm caterpillar, Euvanessa antiopa Linn., locust borer, Prionoxystus robiniae Peck, poplar borer, Saperda calcarata Say, cottonwood leaf beetle, Lina scripta Fabr. and cottony mapletree scale insect, Pulvinaria innumerabilis Rathv.

Tussock Moth (Country Gentleman, Ap. 24, 1902, 67:351[24])

Remedial measures are given for the white marked tussock moth, Notolophus leucostigma Abb. & Sm

Scale Insects (Country Gentleman, May 1, 1902, 67:370[14])

Remedial measures for Chionaspis furfura Fitch and Aspidiotus perniciosus Comst. from Dorchester Mass.

May Beetles (Country Gentleman, May 8, 1902, 67:390[15])

There is no practical method of protecting trees from Lachnosterna ? fusca Fröhl.

Bagworms (Country Gentleman, May 8, 1902, 67:390[16])

The winter retreats, containing from 532 to 1284 eggs, are described and remedies are given for Thyridopteryx ephemeraeformis Haw.

Grape Root Worm (Country Gentleman, May 15, 1902, 67:413[11])

General account of Fidia viticida Walsh in New York and a discussion of remedies.

Tent Caterpillars (Country Gentleman, May 15, 1902, 67:414[13])

Brief note of warning in regard to Clisiocampa americana Fabr. and C. disstria Hübn.

Insect Pests and Plant Diseases (N. Y. State Lib. Bul. 72. 1902. p.181–83)

General summary of earlier laws and review of those enacted in the United States in 1901.

Insects in New York (Country Gentleman, May 22, 1902, 67:434[45])

Summary of reports from voluntary observers.

Appletree Tent Caterpillar (Country Gentleman, May 22, 1902, 67:438[46]–39)

Remedies are given for Clisiocampa americana Fabr. and the habits of the fall webworm, Hyphantria cunea Drury [textor Harris], are briefly described.

Onion Thrips (Country Gentleman, May 29, 1902, 67:451[13])

Injuries and remedies for Thrips tabaci Lind.

Insects in New York (Country Gentleman, May 29, 1902, 67:454[28])

Summary of reports from voluntary observers.

Elm Tree Bark Louse (Country Gentleman, June 5, 1902, 67:471[11])

The habits and remedies for Gossyparia ulmi Geoff. are given.

Insects in New York (Country Gentleman, June 5, 1902, 67:471[29])

Summary of reports from voluntary observers.

Hopvine Aphis (Country Gentleman, June 12, 1902, 67:490[25])

Life history and remedial measures for Phorodon humuli Schrank.

Owl Beetle (Country Gentleman, June 12, 1902, 67:490[35])

Description and habits of Alaus oculatus Linn.

Gartered Plume Moth (Country Gentleman, June 12, 1902, 67:491[12])

Life history and remedies for Oxyptilus periscelidactylus Fitch

Insects in New York (Country Gentleman, June 12, 1902. 67:499[24])

Summary of reports from voluntary observers.

Insects of New York (Country Gentleman, June 19, 1902, 67:519[27])

Summary of reports from voluntary observers.

Lined Spittle Hopper (Country Gentleman, June 26, 1902, 67:530[47])

The work of Ptyelus [Philaenus] lineatus Linn. on grass described, and Aphrophora paralella Say on hard pine mentioned.

Silver Tip (Country Gentleman, June 26, 1902, 67:531[34])

This may be the work of several insects: Limothrips poaphagus Comst., larvae of Chlorops and Meromyza or Jassidae.

Insects in New York (Country Gentleman, June 26, 1902, 67:539[25])

Summary of reports from voluntary observers.

Grapevine Root Worm (Country Gentleman, July 10, 1902, 67:574–75)

Cultivation will destroy a large proportion of the pupae of Fidia viticida Walsh.

Insects in New York (Country Gentleman, July 10, 1902, 67:579[20])

Summary of reports from voluntary observers.

[Directions for Collecting Mosquitos] (Argus [Albany] July 27, 1902, p.14; Waterloo Observer, July 25, 1902, p.1)

Request for specimens from all parts of the State with directions for collecting.

Spread of Elm Leaf Beetle (New York Farmer, Aug. 21, 1902, p.4)

Observations on spread of Galerucella luteola Müll. about Albany and its carriage by electric cars.

Aquatic Insects of the Saranac Region (Forest, Fish and Game Commission. 6th Rep't, 1901 [issued Aug. 1902] p.499–531, six colored plates)

The introduction briefly describes the investigations of the office and discusses the complexity and interrelations existing among aquatic forms, with a chapter on the value of insects as food for fish. The economic importance of the following orders as fish food is briefly treated: stone flies (Plecoptera), May flies (Ephemeridae), dragon flies (Odonata), fish flies, dobson and others (Neuroptera), caddis flies (Trichoptera) and flies (Diptera). Brief notes from Dr Needham's report (Museum bulletin 47) are given on the species known to occur in the region, and most of the illustrations are taken from the same publication.

Injuries by Elm Leaf Beetle (Albany Evening Journal, Aug. 26, 1902, p.10)

Brief note calling attention to injuries by Galerucella luteola Müll.

San José Scale (Country Gentleman, Aug. 28, 1902, 67:711[17])

Remedies for Aspidiotus perniciosus Comst.

Elm Leaf Beetle [Galerucella luteola Müll.] in New York State (N. Y. State Mus. Bul. 57, Entomology 15, p.1–43, 8pl. [revised edition of Museum bulletin 20, issued Aug. 27])

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Hag Moth Caterpillar (Country Gentleman, Sep. 4, 1902, 67:730[25])

The food habits and life history of Phobetron pithecium Abb. & Sm. are given.

17th Report of the State Entomologist on Injurious and Other Insects of the State of New York (N. Y. State Mus. Bul. 53. 1901. [Issued Sep. 12, 1902] p.699–925, 29fig. 6pl.)

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Scale Insects of Importance (American Gardening, Sep. 13, 1902, 22:593–94)

Reprint of portions of Museum bulletin 46 on above group.

Asparagus Beetle (Country Gentleman, Oct. 2, 1902, 67:810)

Remedies for Crioceris asparagi Linn.

Report on Insects (N. Y. State Fruit-Growers Ass'n Rep't. 1902. 6th An. Rep't 1902. p.210–18)

Brief notes on the unusual occurrence of a number of southern species.

Report of the Committee on Insects (Eastern N. Y. Hortic. Soc. 6th An. Rep't 1902. p.210–18)

Some general observations on the abundance of southern forms are given together with notes on the value of trap lanterns, and the results of recent experiments with various insecticides against San José scale. The injuries inflicted by various bark borers are briefly recorded, and the following insects are noticed: Hickory bark borer, Scolytus 4-spinosus Say; elm leaf beetle, Galerucella luteola Müll; grapevine Fidia, Fidia viticida Walsh; forest tent caterpillar, Clisiocampa disstria Hübn.; Cenopis diluticostana Walsm.; carrot rust fly, Psila rosae Fabr.; rose scale insect, Aulacaspis rosae Sandb.; European praying mantis, Mantis religiosa Linn.

CONTRIBUTIONS TO COLLECTION OCT. 16, 1901–OCT. 15, 1902

Hymenoptera

Eumenes fraternus Say, fraternal potter wasp, cells on small branch, May 10; from **G. S. Graves**, Newport N. Y.

Agapostemon radiatus Say, Oct. 8; from Mrs **E. C. Anthony**, Gouverneur N. Y.

Thalessa atrata Fabr., the black long-sting, June 17; from **C. Horton**, Albany N. Y.

Microgaster sp., cocoons, Nov. 11; from **L. L. Woodford**, Lyndonville N. Y.

Cratotechus sp., pupal cases on soft maple, July 27; from **W. T. Ropes**, Montclair N. J.

Tremex columba Linn., pigeon tremex, Aug. 30; from **W. S. Evans**, Newport N. Y.

Monostegia ignota Nort., strawberry sawfly, larvae on strawberry plants, June 2; from **C. L. Williams**, Glens Falls N. Y.

Eriocampoides limacina Retz., peartree slug, larva on cherry, Sep. 12; from **Calvin Shaffer**, Albany N. Y.

Coleoptera

Scolytus quadrispinosus Say, adults and larvae on hickory logs, January; from **W. W. Wadsworth**, Geneseo N. Y.

Cryptorhynchus lapathi Linn., willow snout beetle, on poplar and willow, July 18; from **C. W. Stuart & Co.**, Newark N. Y. Same on willow, Aug. 28; from **J. Jay Barden**, Newark N. Y.

Pissodes strobi Peck, the white pine weevil, pupae and adults, Aug. 28; from **Ernest H. Crosby**, Rhinebeck N. Y.

Lixus concavus Say, rhubarb curculio, June 26; from **H. H. Ballard**, Pittsfield Mass.

Epicauta cinerea Forst., margined blister beetle on potatoes, July 14; from **G. F. Bixby**, Plattsburg N. Y.

Chelymorpha argus Licht., argus beetle, adults on corn, July 18; from **S. B. Huested**, Blauvelt N. Y.

Galerucella luteola Müll., elm leaf beetle, adults on elm, Ap. 25; from **S. S. Vrooman**, Schenectady N. Y.

Fidia viticida Walsh, grapevine root worm, larvae on grapevine, Ap. 24; from Westfield N. Y. Same, May 18; from **F. A. Morehouse**, Ripley N. Y.

Oberea bimaculata Oliv., raspberry cane-girdler, adult on raspberry, July 11; from Dr **C. C. Schuyler**, Plattsburg N. Y.

Saperda fayi Bland, larvae in crataegus, Ap. 17; from **M. F. Adams**, Buffalo N. Y.

Monohammus confusor Kirby, the sawyer, adults, July 3; from **Carlton Turner**, Worcester N. Y. Same on pine, Aug. 4; from **B. Middlebrook**, Albany N. Y.

Prionus laticollis Drury, broad-necked Prionus, larva and pupa, June 24; from **G. S. Graves**, Newport N. Y.

Orthosoma brunneum Forst., straight-bodied Prionus, July 30; from **James E. Barkley**, Grahamsville N. Y.

Pelidnota punctata Linn., spotted grapevine beetle, adult, Aug. 4; from **L. Emmet**, Albany N. Y.

Dicerca divaricata Say, divaricated Buprestid, July 30; from **James E. Barkley**, Grahamsville N. Y.

Wireworm, undetermined, infested with Cordyceps acicularis, Dec. 25; from **C. W. Nash**, Toronto Can.

Alaus oculatus, Linn., owl beetle, adult, June 3; from **C. P. S.**, Schenectady N. Y. Same June 18; from **B. D. Van Buren**, Olcott N. Y. Same July 30; from **James E. Barkley**, Grahamsville N. Y.

Attagenus piceus Oliv., black carpet beetle, larvae in flour warehouse, May 21; from **Julian Van Deusen**, Hudson N. Y.

Silvanus surinamensis Linn., saw-toothed grain beetle, adult on oats, Oct. 18; from Mr **Freer**, Albany N. Y.

Chilocorus bivulnerus Muls., twice-stabbed ladybug, adults on San José scale-infested tree, May 2; from **J. J. Hicks**, Jericho L. I. Same, pupa on apple, Aug. 23; from **W. L. Downing**, Oneida N. Y.

Diptera

Psila rosae Fabr., the carrot rust fly, larvae in celery roots, Dec. 30; from **James Granger**, Broadalbin N. Y.

Lasioptera vitis O.S., grapevine gall insect, larvae in galls on grape leaves and stem, June 16; from **J. Jay Barden**, Westfield N. Y.

Culex excrucians Walk. and Anopheles punctipennis Say, mosquitos, adults, July 25; from **Percy L. Huested,** Pine Island N. Y.

Rhabdophaga salicis Schrank, European willow gall midge, larvae on European willow, Ap. 15; from **H. C. Peck,** Rochester N. Y.

Lepidoptera

Euvanessa antiopa Linn., spiny elm caterpillar, larvae on willow, alder, June 22; from **G. S. Graves,** Newport N. Y. Same, on willow (Salix discolor), June 30; from **C. R. Pettis,** Saranac Junction N. Y.

Eurymus philodice Godt., clouded sulfur, adult, Oct. 22; from **J. P. Van Ness,** East Greenbush N. Y.

Heraclides cresphontes Cram., giant swallowtail, July 15; from **Henry Griffis,** Newpaltz N. Y.

Hemaris diffinis Bdv., July 30; from **James E. Barkley,** Grahamsville N. Y.

Amphion nessus Cram., June 16; from **J. F. Rose,** South Byron N. Y.

Thyreus abbotii Swains., Abbot's sphinx, larvae on Ampelopsis, July 25; from **W. B. Phipp,** Delmar N. Y.

Philampelus pandorus Hübn., pandorus sphinx, larva on grape, May 30; from **H. L. Griffis,** Newpaltz N. Y.

Phlegethontius celeus Hübn., tomato worm, on tomato, Aug. 21; from **C. H. Peck,** Menands N. Y. Same, adult, Aug. 30; from Dr **U. G. Williams,** Newport N. Y.

Sphinx drupiferarum Abb. & Sm., plum sphinx, June 16; from **J. Jay Barden,** Westfield N. Y. Same, male and female, June 17; from **J. H. Dodge,** Rochester N. Y.

? Paonias excaecatus Abb. & Sm., blind-eyed sphinx, young larvae on oak, June 20; from **Rhoda Thompson,** Ballston Spa N. Y.

Arctia virgo Linn., July 30; from **James E. Barkley,** Grahamsville N. Y.

Pyrrharctia isabella Abb. & Sm., the black and red woolly bear, larvae, Oct. 22; from **J. P. Van Ness,** East Greenbush N. Y.

Notolophus antiqua Linn., larva on Crataegus, July 22; from **G. S. Graves,** Newport N. Y.

Phobetron pithecium Abb. & Sm., hag moth caterpillar, larva on maple, Aug. 26; through *Country Gentleman,* Westwood N. Y.

Thyridopteryx ephemeraeformis Haw., bagworm, bags on cedar, Jan. 24; from Dr **M. W. Van Denburg,** Mount Vernon N. Y. Eggs of same on yellow locust, Ap. 21; from **J. J. Hicks,** Jericho L. I. Eggs of same on plum, Ap. 28; from **Weaverling & Biddle,** Everett Pa. Same on arbor vitae, May 6; from Mrs **E. H. Mairs,** Dobbs Ferry N. Y.

Schizura concinna Abb. & Sm., red-humped appletree worm, larva on apple, Oct. 4; from **Cyrus R. Crosby,** Penn Yan N. Y.

Tropaea luna Linn., luna moth, adult, June 3; from **J. H. McClure,** Franklinville N. Y. Same; from **James E. Barkley,** Grahamsville N. Y.

Telea polyphemus Linn., polyphemus moth, Aug. 9; from **B. Middlebrook,** Albany N. Y.

Clisiocampa americana Fabr., appletree tent caterpillar, larva on appletree, May 11; from **Lloyd Balderston,** Colora Md.

Xylophasia arctica Bdv., July 30; from **James E. Barkley,** Grahamsville N. Y.

Hydroecia species, larva on ginseng, July 30; from **H. W. Elmendorf,** Coeymans Hollow N. Y.

Euthisanotia grata Fabr., beautiful wood nymph, adult on hollyhock, June 30; from **F. A. Fitch,** Randolph N. Y. Same on Boston ivy, June 30; from Mrs **E. C. Anthony,** Gouverneur N. Y. Same, July 30; from **James E. Barkley,** Grahamsville N. Y. Same, Aug. 2; from **G. S. Graves,** Newport N. Y.

Heliothis armiger Hübn., the corn worm, larvae on corn, Aug. 25; from Dr **M. W. Van Denburg,** Mount Vernon N. Y.

Geometrid sp., larva on Crataegus, July 22; from **G. S. Graves,** Newport N. Y.

Pyralis costalis Fabr., clover hay caterpillar, larvae in timothy hay, Ap. 9; from **George B. Kinney,** Amenia N. Y.

? Tetralopha species, larvae on maple, Sep. 2; from **E. H. Crosby,** Rhinebeck N. Y.

Dioryctria abietella Shiff., larvae in spruce cones, Sep. 24; from **C. R. Pettis,** Fulton Chain N. Y.

Ephestia kuehniella Zell., Mediterranean flour moth, pupae in graham flour, Oct. 4; from Dr **M. W. Van Denburg,** Mount Vernon N. Y.

Oxyptilus periscelidactylus Fitch, gartered plume moth, larvae on grapevine, June 2; from **David Muirhead,** Staten Island N. Y. Same, June 10; from **Verplanck Colvin,** Albany N. Y.

Phoxopteris nubeculana Clem., apple leaf-folder, larvae on apple, Sep. 4; from **Charles V. Winne,** Albany.

Coleophora fletcherella Fern., cigar case-bearer, larvae, Nov. 1; from **F. D. A.,** Wings Station N. Y.

Coleophora limosipennella Dup., larvae on Scotch elm, July 18; from **Walter W. Hoover,** Brooklyn N. Y.

Bucculatrix canadensisella Chamb., birch Bucculatrix, larvae on birch, Sep. 16; from **C. H. Peck,** Lake Placid N. Y.

Aspidisca splendoriferella Clem., resplendent shield-bearer, cocoon on apple, January; through State Dep't Agric., Chautauqua county, N. Y.

Neuroptera

Chrysopa sp., lace-winged fly, adult, June 10; from **Verplanck Colvin,** Albany N. Y.

Corydalis cornuta Linn., horned corydalis, male, July 10; from **J. N. Wright,** Grand Gorge N. Y. Same, July 21; from **F. W. Vail,** Milton N. Y. Same, July 30; from **J. R. Boynton,** Altamont N. Y. Same, Aug. 1; from **C. A. Wieting,** Cobleskill N. Y. Same, Sep. 12; from **C. E. Chapman,** Peruville N. Y.

Hemiptera

Blissus leucopterus Say, chinch bug, adults on rye, June 18; from **Purley Minturn,** Locke N. Y.

Phymata wolffii Stal., ambush bug, adult on pear Sep. 1; from **J. F. Rose,** South Byron N. Y.

Stenopoda culiciformis Fabr., adult, August; from **H. H. Ballard,** Pittsfield Mass., from the South.

Typhlocyba comes var. vitifex Fitch, grapevine leaf-hopper, work on grape leaves, June 3; from **J. Jay Barden,** Westfield N. Y.

Philaenus lineatus Linn., lined spittle hopper, young on grass, June 18; from **L. L. Woodford,** Scriba N. Y.

Ceresa bubalus Fabr., Buffalo tree hopper, eggs in pear twig, Oct. 25; from **L. L. Woodford,** Waterport N. Y.

Chionaspis americana Johns., elm scale insect, adult females on elm, Jan. 16; from **J. Jay Barden,** Newark N. Y.

Chionaspis furfura Fitch, scurfy bark louse, eggs on apple, Jan. 6; from **C. H. Stewart,** Newark N. Y. Same, eggs on pear, Ap. 19; **O. F. R.,** Dorchester Mass. Same, on apple, Aug. 23; from **W. L. Downing,** Oneida N. Y. Same, on pear, Aug. 28; from **J. H. Dodge,** Olcott N. Y.

Mytilaspis pomorum Bouché, appletree bark louse, adults on apple, Mar. 29; from **E. R. Hequan,** Washington county, N. Y. Eggs of same on willow, May 23; from **S. T. Skidmore,** East Hampton N. Y.

Aulacaspis rosae Sandb., rose scale, adults and young on crimson rambler rose, Oct. 15; from **C. W. Calkins,** Cobleskill N. Y. Same, females on raspberry, Oct. 17; from **J. F. Mara,** Cornwall N. Y. Same, females on blackberry, Oct. 30; from **Chester Young,** New York city. Same, females on rose, Jan. 16; from **J. Jay Barden,** Stanley N. Y.

Chrysomphalus aonidum Linn., young females on rubber plant, Nov. 30; from **L. L. Woodford.** Lyndonville N. Y.

Diaspis pentagona Targ., West Indian peach scale, adult females on cherry, Jan. 23; from **Chester Young,** New York customhouse N. Y.

Aspidiotus ancylus Putn., Putnam's scale, adult, Oct. 18; from **H. C. Peck,** Rochester N. Y. Same, young females on Osage orange, Oct. 29; from **P. L. Heusted,** Coxsackie N. Y. Same, adult female on currant, Dec. 13; from **C. H. Darrow,** Geneva N. Y. ? Same, on ? Acer pennsylvanicum, Ap. 15; from **J. F. Rose,** South Byron N. Y. Same, females on Kieffer pear, May 12; from **B. D. Van Buren,** Albion N. Y. Same, young, second stage, on willow, May 12; from **Chester Young,** New York city.

Aspidiotus forbesi Johns., cherry scale insect, female on apple, Oct. 30; from **Chester Young,** Westchester Pa. ? Same, young, second stage, on peach, Ap. 2; from **P. L. Heusted,** Highland N. Y.

Aspidiotus hederae Vallot, white scale insect of the ivy, adults on ivy, Mar. 29; from **J. Richards,** Sherborn Mass.

Aspidiotus ostreaeformis Curtis, European fruit tree scale insect, young females on plum, Oct. 25; from **C. W. Cole,** Irondequoit N. Y. Same, or ancylus Putn., second stage young on pear, Oct. 25; from **C. W. Cole,** Irondequoit N. Y. Same, young female on plum, Nov. 15; from **L. L. Woodford,** Lyndonville N. Y. Same, adult females, young, on lilac, Mar. 15; State Dep't Agric., Belgium, Europe. Same, adult female on plum, June 13; from **B. D. Van Buren,** Olcott N. Y.

Aspidiotus perniciosus Comst., San José scale, female on apple, Oct. 28; from **B. D. Van Buren,** Waterport N. Y. Same, adults and young, on willow, Mar. 27; from **C. L. Allen,** Floral Park L. I. Same, young females on apple, May 5; from **J. F. Johnson,** Breakabeen N. Y. Young of same on peach, May 22; from **Louis F. Brown,** Washingtonville N. Y. All stages of same on apple, Aug. 13; from **Emily Thomas,** Union Springs N. Y.

Lecanium nigrofasciatum Perg., adults on willow, Mar. 24; from **J. J. Barden,** Stanley N. Y.

Lecanium pruinosum Coq., frosted lecanium, eggs on American elm, May 30; from **J. M. Southwick,** Providence R. I.

Lecanium ? quercitronis Fitch, adults on ironwood, June 11; from **C. E. Eldridge,** Leon N. Y.

Lecanium tulipiferae Cook, tuliptree scale, young on tuliptree, Jan. 20; from Mrs **E. H. Mairs,** Irvington N. Y.

Pulvinaria innumerabilis Rathv., cottony mapletree scale insect, adults on maples, June 11; from **C. E. Eldredge,** Leon N. Y. Same, on elm, July 27; from **W. T. Ropes,** Montclair N. J.

Eriopeltis sp., adults on grass, collected in August 1899; from **C. O. Houghton,** Stark N. Y.

Gossyparia ulmi Geoff., elm bark louse, adults on American elm, May 19; from **O. Q. Flint,** Athens N. Y. Same, females on elm, May 23; from **J. M. Southwick,** Providence R. I. Same, females on weeping elm, May 24; from **T. C. M.,** New Dorp N. Y.

Pemphigus populicaulis Fitch, adults on poplar, June, 23; from **W. B. Melius,** Albany N. Y.

Phylloxera caryaecaulis Fitch, hickory gall aphid, galls on leaf stalks of hickory, June 16; from **L. L. Woodford,** Madison county. Same, few females and many young on hickory, June 17; from Dr **F. W. Seward,** Goshen N. Y.

Phylloxera vitifoliae Fitch, galls on Delaware grapevines, Sep. 4; from **P. L. Heusted**, Marlboro N. Y.

Schizoneura americana Riley, elm leaf aphis, adults on American elm, May 30; from **J. M. Southwick**, Providence R. I.

Orthoptera

Oecanthus angustipennis Fitch, adult, Sep. 22; from **H. L. Griffis**, Newpaltz N. Y.

?Microcentrum retinervis Burm., katydids, eggs on magnolia twig, Ap. 15; through State Dep't Agric., Rockland county. Same, eggs on apple, Nov. 4; from **W. L. M.**, Augusta county, Va.

Diapheromera femorata Say, walking stick, Oct. 9; from **L. L. Woodford**, Berwyn N. Y.

Tenodera sinensis Sauss., Chinese praying mantis, eggs on imported Japanese maples, Ap. 12; from **P. L. Huested**, Blauvelt N. Y.

Acarina

Trombidium locustarum Riley, locust mite, half grown young on grasshopper, Sep. 17; from **Henry L. Griffis**, Newpaltz N. Y.

Myriapoda

Julus ?caeruleocinctus Wood., young on strawberries, June 24; from **C. H. Peck**, Menands N. Y.

Vermes

Gordius sp., hair worm on hair snake, coiled in knots in soil, May 12; from **C. E. Eldredge**, Leon N. Y.

EXPLANATION OF PLATES

PLATE 1[1]

Brown tail moth

Euproctis chrysorrhoea Linn.

1 Egg mass on the underside of a pear leaf and also on twig
2 Young caterpillars or larvae as they appear in early spring
3 Half grown and full grown caterpillars
4 Pupae in portion of a web mass, also a few cast larval skins
5 Male moth at rest
6 Female moth with wings partly extended
7 Hibernating tents in which the winter is passed

PLATE 2

Tree 114 was sprayed with undiluted petroleum Ap. 11, 1900, and with a 20% mechanical petroleum emulsion in the spring of 1901 and of 1902. The first application undoubtedly injured the tree considerably, but under the later treatments it has been recovering, as is evidenced by the new twigs shown in the view taken Mar. 10 and the abundant bloom of May 6.

Tree 66 was treated with a combination of whale oil soap and crude petroleum in April 1900 and with 25% and 20% mechanical crude petroleum emulsion in the springs of 1901 and 1902 respectively. It was severely cut back in 1901, and the recent growth gives no indication of weakness.

PLATE 3

Tree 101 was sprayed with undiluted crude petroleum in April 1900 and severely injured. The following spring it was treated with a combination of whale oil soap and petroleum and in the spring of 1902 with a 20% mechanical emulsion. It has developed a large amount of vigorous new wood.

Tree 69 was treated with a combination of whale oil soap and crude petroleum in April 1900, and with 25% and 20% mechanical crude petroleum emulsion respectively in the spring of 1901 and 1902. The vigorous growth under this treatment is very apparent.

[1]Executed from nature under the author's direction by L. H. Joutel.

PLATE 4

Tree 4 was sprayed with the lime, salt and sulfur mixture in the spring of 1902 with no indication of injury to the bloom.

Tree 113 was treated in April 1900 with a mixture of whale oil soap and crude petroleum and the two following springs with a 20% mechanical crude petroleum emulsion. There is no sign of injury, and the profuse bloom shows that the buds were not harmed.

PLATE 5

Trees 41 and 47 have been sprayed three springs in succession with a 20% mechanical crude petroleum emulsion, except that in the case of the former a 25 % emulsion was applied in 1901. Little or no injury has resulted, and the somewhat abundant bloom shows that the buds were not affected to any extent.

PLATE 6

1 Work of willow and poplar curculio, Cryptorhynchus lapathi Linn.

2 Nun moth, Psilura monacha Linn; slightly enlarged.

3 Birch leaf Bucculatrix, Bucculatrix canadensisella Chamb., *a,* skeletonized leaf; *b,* molting cocoon; *c,* larva; *d,* head of larva; *e,* anal segments of larva; *f,* same of pupa; *g,* cocoon with extruded pupal skin; *h,* moth — all enlarged. (From *Insect Life*)

L. H. Joutel, 1902

Brown-tail moth

Tree 114 Photo March 10
Seckel pear

Tree 114 Photo May 6
Seckel pear

Tree 66 Photo March 10
Bartlett pear

Tree 101 Photo March 10

Seckel pear

Tree 69 Photo March 10

Howell pear

Tree 4 Photo May 6

Wild cherry

LIME, SALT AND SULFUR, 1902

Tree 113 Photo May 6

Beurre d'Anjou pear

THREE YEARS OF CRUDE PETROLEUM

Tree 41 Photo May 6

Crawford peach

Tree 47 Photo May 6

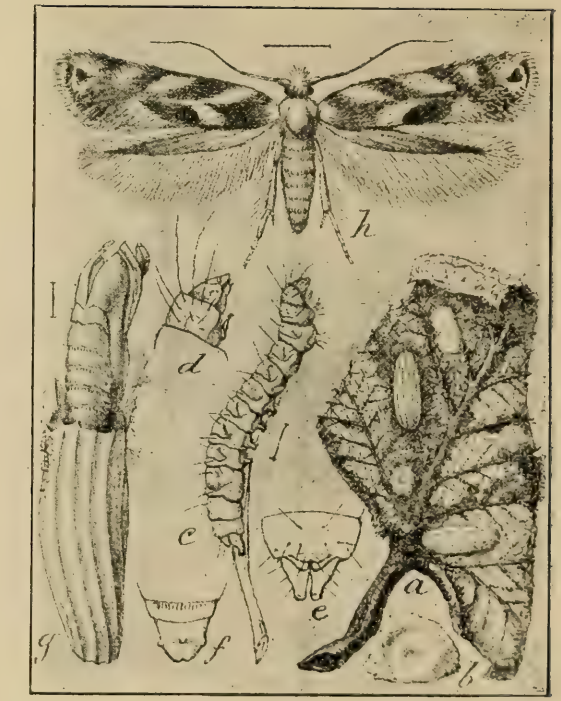
Old Mixon peach

1

Willow and poplar curculio

2

Nun moth



3

Birch Bucculatrix

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