BULLETIN 265 MARCH, 1925

Connecticut Agricultural Experiment Station
New Haven, Connecticut

TWENTY-FOURTH REPORT

OF THE

STATE ENTOMOLOGIST

OF

CONNECTICUT

1924

W. E. BRITTON, Ph.D.
State Entomologist

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CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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March, 1925.

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Authorship.

For bibliographical purposes, all matter in this Report (Bulletin 265) should be credited to W. E. Britton, except where otherwise indicated.

Illustrations.

The illustrations in this Bulletin are from the following sources: text figures are from drawings as follows: Fig. 7, map drawn by Alex. Cahn and shaded by Stoddard; Figs. 8-15, drawn by B. H. Walden. Plates are from photographs: Plate XXXVI, b, by R. B. Friend; XXX, b, by Dr. Philip Garman; XXXIII, b and c, by Nicholas Matiuck; XXIV, b, and XXV, a, by J. L. Rogers; XXXIII, a, and XXXIV, by R. C. Botsford; XVII, XVIII, b, XIX, XX, XXI, a, XXV, b, and XXIX, c, by W. E. Britton; XVIII, a, XXI, b, XXII, XXIII, XXIV, a, XXVI, XXVII, XXVIII, XXIX, a and b, XXX, a, b, c, d and e, XXXI, XXXII, XXXV, and XXXVI, a, by B. H. Walden.

BULLETIN 265

TWENTY-FOURTH REPORT

OF THE

State Entomologist of Connecticut

To the Director and Board of Control of the Connecticut Agricultural Experiment Station.

I have the honor to transmit, herewith, my twenty-fourth annual report as State Entomologist of Connecticut. As in preceding years, the report covers the activities of the Department of Entomology, as regards both the control and inspection work provided for by Statute, and the various lines of research which after all more properly represent the type of effort for which Agricultural Experiment Stations were established.

Respectfully submitted,

W. E. BRITTON,
State and Station Entomologist.

INSECT PEST ACCOUNT.

REPORT OF RECEIPTS AND EXPENDITURES OF THE STATE ENTOMOLOGIST

From July 1, 1923 to June 30, 1924.

RECEIPTS.

From W. L. Slate, Jr., Treasurer		$15,000.00	
Added to appropriation from miscellaneous receipts by State Board of Control		759.18	
Miscellaneous receipts during year	$82.55		
	117.79		
	400.30		
	30.92	631.56	
			$16,390.74
Less miscellaneous receipts deposited with State Treasurer during the year			600.64
			$15,790.10

EXPENDITURES.

For Salaries and Wages	$11,022.34
Printing and Illustrations	79.23
Postage	22.29
Stationery	36.63
Furniture and Fixtures	316.43
Books and Periodicals (new)	61.61
Books and Periodicals (binding)	128.25
Laboratory Supplies	186.26
Spraying Supplies	116.44
Express, Freight and Cartage	20.67

Automobiles: Insurance	$ 86.39	
Supplies and Equipment	97.95	
Repairs	173.36	
Gasoline	206.99	
Oil	10.55	
Traveling Expenses	482.03	
Miscellaneous	2.40	
Telephone and Telegraph	2.34	
Rental and Storage	2.50	
		$13,054.66
Balance on hand June 30, 1924	$2,704.52	
Miscellaneous receipts	30.92	2,735.44
		$15,790.10

Memorandum.—This account has been audited by the State Auditors of Public Accounts and the balance returned to the State Treasurer.

SUMMARY OF INSPECTION AND OFFICE WORK.

337 samples of insects received for identification.
122 nurseries inspected.
118 regular certificates granted.
5 special raspberry certificates granted.
116 duplicate certificates furnished to be filed in other states.
109 parcels of nursery stock inspected and certified.
953 bales of mountain laurel and willow (21 trips) inspected and certified for shipment into New York.
49 orchards and gardens examined.
33 shipments, containing 313 cases, 3,489,170 plants, imported nursery stock inspected.
17 shipments, or 51 per cent. found infested with insects or fungi.
953 apiaries, containing 8,929 colonies inspected.
17 apiaries and 47 colonies found infested with European foul brood.
10 apiaries and 20 colonies found infested with American foul brood.
2,265 letters written on official work.
456 circular letters.
591 post cards.
46 reports to Federal Horticultural Board.
2,303 bulletins, etc., mailed on request or to answer inquiries.
70 packages sent by mail or express.
38 lectures and addresses at institutes, granges and other meetings.

PUBLICATIONS OF THE ENTOMOLOGICAL DEPARTMENT, 1924.

BY W. E. BRITTON:

Twenty-third Report of the State Entomologist of Connecticut (Bulletin 256), 96 pages, 8 figures, 16 plates; 10,500 copies distributed in July.
Inspection of Nurseries in 1923, 8 pages, reprinted from the Report.
The Apple and Thorn Skeletonizer, Bulletin of Immediate Information 39, May 17.
Spraying Shade Trees, Bulletin of Immediate Information 40, May 20.
The Apple Maggot or Railroad Worm, Bulletin of Immediate Information 43, June 16.
The Gipsy Moth Quarantine, Bulletin of Immediate Information 44, 4 pages, July 15.
Report of Committee on Injurious Insects, Proceedings 33rd Annual Meeting Connecticut Pomological Society, page 41, 1924.

Some Insects to be Combatted Next Season, Proceedings 33rd Annual Meeting, Connecticut Pomological Society, page 72, 1924.
Insects Attacking Vegetable Crops in Connecticut in 1923, Report Connecticut Vegetable Growers' Association, page 43, April 1924.
An Asiatic Beetle (*Anomala orientalis*) in Connecticut, Journal of Economic Entomology, Vol. 17, page 309, April, 1924.
The Gipsy Moth and Our Forests, New England Farms, June 21, 1924.
Connecticut Tree Workers' Institute, Florists' Exchange, Vol. LVII, page 890, March 22, 1924.
Proceedings Shade Tree Conference, Florists' Exchange, Vol. LVIII, page 703, September 6, 1924 (also a four-page reprint).
Some Insect Information from a Connecticut Conference, Florists' Exchange, Vol. LVIII, Supplement Page A, November 29, 1924.
Meeting of Connecticut Entomologists, Journal of Economic Entomology, Vol. 17, page 669, December, 1924.

By W. E. Britton, Philip Garman, G. P. Clinton and E. M. Stoddard:
Information about Insecticides and Fungicides, Bulletin of Immediate Information 30, March 26.
Why and How to Spray, Bulletin of Immediate Information 31, March 28.

By W. E. Britton and Philip Garman:
Dormant Sprays for Orchard Pests, Bulletin of Immediate Information 29, March 22.

By W. E. Britton, G. P. Clinton and W. O. Filley:
Tree Workers Holding Connecticut Certificates, Bulletin of Immediate Information 35, 4 pages, April 25.

By W. E. Britton and R. C. Botsford:
Mosquitoes and Human Welfare by W. E. Britton, and Mosquito Control Work, Season of 1923 by R. C. Botsford, 16 pages, 2 plates (1,000 copies reprinted from Report), June 24.

By Philip Garman:
The European Red Mite, Bulletin 252, 25 pages, 2 figures, 2 charts, 4 plates; 10,600 copies, February 1924.
Control of European Red Mite in Connecticut, Proceedings, 33rd Annual Meeting, Connecticut Pomological Society, page 44, 1924.
The Oriental Peach Moth, Bulletin of Immediate Information 41, May 20.
Factors Influencing the Effectiveness of Arsenate of Lead, Florists' Exchange, Vol. LVIII, page 685, September 6.

By B. H. Walden:
The Raspberry Fruit Worm, Bulletin 251, 11 pages, 1 figure, 4 plates; 10,600 copies, February 1924.
The Raspberry Fruit Worm, Proceedings, 33rd Annual Meeting, Connecticut Pomological Society, page 124, 1924.
Spray for the Imported Currant Worm, Bulletin of Inmediate Information 34, April 21.

By M. P. Zappe and E. M. Stoddard:
Results of Dusting *versus* Spraying in Connecticut Apple and Peach Orchards in 1922, Crop Protection Digest, Bulletin Series No. 4, page 2, June 1924.
The Calyx and Later Summer Sprays, Bulletin of Immediate Information 36, May 1.
Peach Spraying, Bulletin of Immediate Information 37, May 3.
Progress of Spraying and Dusting Experiments, Proceedings 33rd Annual Meeting Connecticut Pomological Society, page 52, 1924.

BY M. P. ZAPPE AND G. P. CLINTON:
The Prepink and Pink Sprays for Apples, Bulletin of Immediate Information 33, April 15.

BY R. C. BOTSFORD:
Accomplishments in the Past Year in Anti-Mosquito Work in Connecticut, Proceedings 11th Annual Meeting of the New Jersey Mosquito Extermination Association, page 80, 1924.

DEPARTMENT STAFF AND WORK.

W. E. BRITTON, PH.D., *State and Station Entomologist.*
B. H. WALDEN, B.AGR., *Photographic and General Work.*
M. P. ZAPPE, B.S., *Inspection and General Work.*
PHILIP GARMAN, PH.D., *Research Work.*
} *Assistant Entomologists.*
ROGER B. FRIEND, B. SC., *Graduate Research Assistant.*
JOHN T. ASHWORTH, *Deputy in Charge of Gipsy Moth Work.*
JAMES A. MCEVOY, *Assistant in Gipsy Moth Work.*
ROBERT C. BOTSFORD, *Deputy in Charge of Mosquito Work.*
MISS GLADYS M. FINLEY, *Clerk and Stenographer.*

H. W. COLEY, Westport,
A. W. YATES, Hartford,
} *Apiary Inspectors.*

The only change in the staff during the year was the appointment of Mr. Roger B. Friend, who began his duties January 1, 1924, as part time assistant. Mr. Friend graduated from the Massachusetts Agricultural College in 1923, and was employed for the remainder of that year by the Conservation Commission of New York State, on gipsy moth work. Mr. Friend is studying at Yale University for his doctorate, and is employed at the Station during the time when not busy with his studies. He is investigating the bionomics of the birch leaf skeletonizer and has also given considerable attention to control methods of certain insects attacking vegetable crops. Articles occur elsewhere in this Report giving the results of Mr. Friend's work on Substances Attractive to the Cabbage Maggot Fly, and Experiences in Dusting to Kill the Pea Aphid, Cabbage Aphid and Onion Thrips.

Mr. J. Leslie Rogers was employed as assistant from February 25 until the end of the year. He was engaged until the nurseries had been inspected, then was continued to help in scouting for the European corn borer. Mr. T. F. Cronin was also employed to assist in inspecting nurseries, working from June 23 until September 15, when he returned to his studies at the Connecticut Agricultural College at Storrs. Mr. W. R. Hunt, graduate assistant in the Botanical Department of this Station, was placed on the pay roll of this Department for the three months from July 1 until October 1, and assisted in the inspection of nurseries, paying particular attention to plant diseases.

Mr. Walden has done most of the photographic work of the Department, has had charge of the office in the absence of the Entomologist, and has assisted in scoring apples in the dusting and spraying experiments. He has also conducted some research work on the imported currant worm, *Pteronidea ribesi* Scop.

Mr. Zappe has been in charge of the inspection of nursery stock, and of scouting and clean-up work on account of the European corn borer in co-operation with the Federal Bureau of Entomology. He and Dr. Garman have investigated the life history and control of the Asiatic beetle, and the plum curculio as a pest of apple orchards. In co-operation with Mr. Stoddard of the Botanical Department, he has made further tests of various dusts in comparison with sprays for the control of various insect and fungous pests of apple orchards.

Dr. Garman has conducted investigations regarding methods of control for the Oriental peach moth, the American foul brood disease of bees, has continued his studies on life histories and habits of spittle insects, the European red mite, and, as noted above, jointly with Mr. Zappe, has investigated the plum curculio, and the Asiatic beetle. Dr. Garman has also constantly revised his manuscript on the Odonata or dragon flies of Connecticut, which is now ready and will sometime be published as a bulletin of the State Geological and Natural History Survey.

Mr. Botsford has continued to serve as Deputy to Director W. L. Slate in charge of mosquito elimination work, and Miss Finley has done the necessary clerical and stenographic work of the Department.

The gipsy moth control work has been prosecuted vigorously as in past years, the field work being entirely in charge of Deputy John T. Ashworth, assisted by James A. McEvoy. This work is carried on in co-operation with the Federal Bureau of Entomology and is fully described in this Report.

The apiaries have been inspected as in past years by Messrs. H. W. Coley and A. W. Yates, on a *per diem* basis.

The Entomologist, besides directing the work of the Department and attending to the correspondence of the office, has continued to serve as Associate Editor of the Journal of Economic Entomology, as Chairman of the Tree Protection Examining Board, and as Insect Pest Reporter for the Insect Pest Survey of the Federal Bureau of Entomology. He has in preparation a list of additions and corrections to the Check List of the Insects of Connecticut, which it is hoped can be published at an early date by the State Geological and Natural History Survey.

Messrs. Britton and Walden are collaborators of the Federal Horticultural Board, and Zappe, Garman, Friend and Ashworth are collaborators of the Bureau of Entomology.

In July, a new Chevrolet touring car was purchased and was used nearly all of the time for transporting the men while engaged in the work of inspecting nurseries.

The more important activities of the Department are described in the various papers in the following pages of this Report.

ENTOMOLOGICAL FEATURES OF 1924.

The season of 1924, like that of 1923, was abnormal and began with cool moist weather followed by a drought. Very little rain fell between July 1 and October 1, and the drought of 1924 was even more severe than that of 1923.

Some of the outstanding features of the season were the disappearance in injurious numbers of the apple and thorn skeletonizer, which was so abundant in 1923, the greater increase in the Oriental peach moth, and further infestations of the European corn borer in six towns along the coast.

There has been no serious spread of the gipsy moth, though a few additional towns were found infested by the Federal scouts. Because it was not possible for the Federal men to scout the entire southern portions of New Haven and Middlesex Counties and it was not known whether or not they were infested, some 23 additional towns were included in the quarantined area.

Though a watch has been kept, not a single nest of the brown-tail moth has been seen in Connecticut since 1919.

FRUIT INSECTS.

The tent caterpillar, *Malacosoma americana* Fabr., continued to be abundant throughout the State, though particularly so in the western portion. Every 10 or 12 years this insect reaches its period of greatest abundance, being comparatively scarce half way between these high periods, probably checked by natural enemies.

The fall canker worm, *Alsophila pometaria* Harris, which is present locally somewhere in the State nearly every year was very abundant in Greenwich and Stamford in early summer and stripped many kinds of deciduous trees, apple, elm, hickory and oak being particularly injured. A few caterpillars were found feeding on maple, but the trees were not stripped. Around New Haven, this insect was present in destructive numbers, but no injury was observed or reports of injury received from outside of New Haven and Fairfield Counties. See Plate XXXII.

The apple and thorn skeletonizer, *Hemerophila pariana* Clerck, which was so prominent and was responsible for so many brown apple trees in 1923, was conspicuous by its absence in 1924. Evidences of its presence could be found in nearly every orchard by the slight skeletonization on terminal leaves, but its work had been arrested, the caterpillars were not there and no particular damage had been done. Apparently natural enemies have been unusually prompt in subduing this insect.

On the other hand, the Oriental peach moth, *Laspeyresia molesta* Busck, was much more in evidence than in 1923, and wormy peaches were rather common in Fairfield and New Haven Counties, late in the season. If this pest continues to spread, its control will

become one of our most important problems. Further details will be found elsewhere in this Report.

The European red mite, *Paratetranychus pilosus* Can. and Fanz., was less abundant in 1924 than in 1923, and no serious injury from its attacks was brought to my attention. Eggs were present in winter in many orchards, especially in the northern portion of the State, but spraying the dormant trees with miscible oils was generally practiced with satisfactory results. Probably the wet spring may have reduced the numbers of this pest, for it was not evident later in the season in most orchards, and I have yet to learn of a single case where it was considered necessary to give a summer spray in 1924 for its control.

The sinuate pear borer, *Agrilus sinuatus* Oliv., continues to spread eastward and it causes some injury at first. This European insect first appeared in the United States in New Jersey some 20 years ago, caused serious injury there for a few years, but is now not regarded as a serious pest. It was first recognized in Connecticut in 1917 at Norwalk, and the writer observed its destructive work in a pear orchard in Stamford in 1920. In May 1924, after the receipt of specimens, Mr. Zappe visited the premises of Mr. W. T. Camp, Shelton, where several old trees had been nearly killed by this insect, and had been removed. Other pear trees in the vicinity had been more or less injured. Probably the best treatment consists in removing and burning the seriously injured trees and branches; then cut out the borers from the remaining portion and coat the bark with a wash of lime-sulphur and lead arsenate to repel the beetles and possibly kill the larvae when they enter the bark. The foliage should also be kept covered with lead arsenate during May and June to kill the adult beetles which feed there before laying eggs. If the trees are kept well fertilized and cultivated, they will be more apt to outgrow injury caused by this insect.

Males of the lime tree winter moth, *Erannis tiliaria* Harris, were fairly abundant flying about lights in the fall, and the greenish-yellow black-spotted females were found on tree trunks. The caterpillars feed upon apple trees and on elm, linden and other trees in the woodlands. The caterpillars feed at about the same time as canker worms, but are larger and there is danger that they will cause some damage the coming season. Spraying with lead arsenate is the remedy. Further information will be found on page 311 of this Report.

The light or false apple red bug, *Lygidea mendax* Reut., was rather less abundant than usual, though it caused some injury locally here and there. Fruit injured by it in Wallingford and Danbury was brought to our attention.

The rosy apple aphis, *Anuraphis roseus* Baker, was rather scarce in most orchards early in the season, though egg-infested twigs were received in March from Middlebury, Middlefield, Milford,

Cannondale and South Glastonbury. On June 9 it was observed in Stamford and Wallingford. By June 24, it was present in moderate numbers in nearly every orchard and injury was caused by it in some cases.

The green apple aphid, *Aphis pomi* DeGeer, hatched in April, and on the 25th at Milford there was an average of about one aphid per bud, but on May 22, practically all aphids had disappeared in the orchards under observation in Milford, New Haven, Hamden and Cheshire.

The woolly apple aphid, *Eriosoma lanigerum* Hausm., seems to be present in nearly every orchard though it is uncertain just how much injury is caused by it. Further information regarding this insect may be found on page 308 of this Report.

The pear psylla, *Psylla pyricola* Foerster, was abundant on pear trees in Wallingford, Southington, Hebron and other places, though in one garden it was less common then for several years. It can be controlled by dormant sprays of nicotine solution and soap, of lime-sulphur and of miscible oils. Sometimes it may be necessary to give a summer treatment either as a spray or dust to prevent blackening of the fruit by later broods.

Leafhoppers were abundant on apple foliage, May 22, in Milford, Hamden and Cheshire.

The plum curculio, *Conotrachelus nenuphar* Herbst, yet remains one of the important pests of the apple orchard and series of experiments have given results which though somewhat contradictory, seem to indicate that thorough applications of lead arsenate at the pink, calyx and two weeks spray, will give fair control. Scarcely any additional benefit could be seen from the seven day treatment. Dr. Garman and Mr. Zappe have already worked two seasons on the five-year program for the study and control of this insect in apple orchards.

The currant aphid, *Myzus ribis* Linn., was present as usual on currant bushes, and specimens were received from Hebron on May 9, and from Colchester on May 16.

A particularly striking case of injured currant twigs attacked by the currant stem girdler, *Janus integer* Nort., was brought to the Station from Woodbridge in April.

Vegetable Insects.

Most of the common insect pests of the vegetable garden were present in 1924, but on account of the backwardness of the season, appeared two or three weeks later than usual. The absence of rain during July, August and September was favorable to some kinds of insect life and unfavorable to plant growth.

The usual amount of injury was caused by cutworms. During June, reports were received of injury to nearly all kinds of vegetable plants in New Haven County, but probably such injuries were not confined to one county but occurred all over the State. A more

general use of poisoned bran mash would certainly reduce the losses occasioned annually by cutworms.

The stalk borer, *Papaipema nitela* Guen., as a pest is fairly constant each year, and tunnels in nearly all kinds of herbaceous stems, even in weeds. It attacks plants here and there, but never are all stems attacked. Growers pay little attention to it, until the stems have been injured. Control measures other than destroying the infested stalks are not successful. Probably on account of the wide distribution of this insect and the character of the injury which it causes, few reports come to this office. However, specimens were received in potato from Terryville, August 7, and in rhubarb from Wethersfield, August 12.

The cucumber or potato flea beetle, *Epitrix cucumeris* Harris, is usually a garden pest each year, and in 1924, was abundant in many fields attacking potato, tomato, egg-plant, cucumber and squash. Reports were received of the abundance of this insect at Woodstock, Brooklyn, Killingly, Cheshire, North Haven, Southington, Plainville and Stratford in June. In the potato field at the Station Farm, Mount Carmel, the beetles were very abundant on the untreated rows, moderately abundant on the rows treated with Niagara potato dust, and much less so on the rows heavily sprayed with Bordeaux mixture and lead arsenate. About 300 gallons per acre was applied on August 2.

On July 18, specimens were received from Shelton of the silver-striped webworm, *Crambus praefectellus* Zinck., which eats into the side of the corn plant near the surface of the ground. Occasionally this insect is the cause of considerable injury, and in 1919, an acre field of corn in New Haven was destroyed by it.

Only limited numbers of the corn ear worm, *Chloridea obsoleta* Fabr., were present on the ears of late maturing corn. Specimens were received on October 17, from Milford, where in one field about five per cent. of the ears were injured. On the whole, this insect did little damage.

The western corn root worm, *Diabrotica longicornis* Say, is present in Connecticut, where it was found in Granby feeding on the petals of flowers. More information regarding this insect may be found under Notes on Miscellaneous Insects in this Report.

One of the tortoise beetles, *Deloyala clavata* Fabr., feeding on potato, was received from Norwalk, July 25. Only rarely are these beetles sufficiently abundant to cause injury, and lead arsenate is an effective remedy, as it is also on foliage for the blister beetles, of which there are several species.

The spinach leaf-miner, *Pegomyia hyoscyami* Panzer, was present around New Haven, Stratford and Westport, in moderate numbers, but Mr. Friend failed to find a badly infested field suitable for a line of experiments which had been planned.

The cabbage maggot, *Hylemyia brassicae* Bouche, was scarce in Litchfield County, but was reported as causing much injury in New

Haven, Hamden, Vernon, Hebron and Ellington late in June. By June 26, it had attacked cabbage and cauliflower in Ridgefield, Bethel and Danbury. Common control measures are tarred paper disks, and the corrosive sublimate treatment, but Mr. Friend obtained good control by trapping the adult flies. His experiments are given in detail on page 314 of this Report.

The green cabbage worm, *Pontia rapae* Linn., though fairly abundant at the Station Farm, Mount Carmel, was generally scarce and caused little damage. In most cases no poison was applied. The cabbage looper, *Autographa brassicae* Riley, was more prevalent than the green cabbage worm, and injured the leaves and heads by riddling them with holes.

Another pest, the parsnip leaf-miner, *Acidia fratria* Loew, was discovered in Wethersfield, July 12. The infestation was slight though the mines were rather extensive in the leaves. The species has before been taken in Connecticut, but we have never observed its injury until 1924. The life history and control measures have not been worked out, and therefore we cannot recommend any treatment.

The onion thrips, *Thrips tabaci* Linde., was found injuring a field of onion sets at Wethersfield. The plants had not been wilted, and on July 16 and 21, nicotine was applied as described on another page of this Report.

Asparagus beetles, *Crioceris asparagi* Linn., and *C. 12-punctata* Linn., were reported as being troublesome at Suffield, June 9; Black Hall, June 18; Riverton, June 24, and Danbury and Norwalk, June 26. As a rule, spraying with lead arsenate after the cutting season is over, and on young beds will control these beetles. Some growers report success with applications of nicotine sulphate.

Aphids of certain kinds were present in usual numbers and caused the usual amount of damage. On August 6, the turnip aphid, *Aphis pseudobrassicae* Davis, was brought to the Station from East Haven, where it had killed and seriously injured turnip plants in a small field. The pea aphid, *Illinoia pisi* Kalt., was not generally troublesome, though it did injure certain fields, and made its appearance very late in the season. It was reported from Thomaston and Danbury on June 24, and a heavy infestation at Ridgefield on June 26. A small field in New Haven was found infested on June 19, and a few days later a small portion of it was dusted with nicotine by Messrs. Friend and Walden. The results are given on page 319 of this Report. The potato aphid, *Macrosiphum solanifolii* Ashm., was rather scarce and only one thoroughly infested field in Branford, was observed on July 1, but the aphids were heavily parasitized. Slight infestations were observed in Westville and Highwood on June 30, but there was no infestation of the potato fields at the Station Farm at Mount Carmel. The cabbage aphid, *Brevicoryne brassicae* Linn., was common through-

out the State, but repeated applications of nicotine dust gave satisfactory control.

A detailed account of the European corn borer infestations and the Asiatic beetle which is still injuring lawns in New Haven will be found on pages 277 and 294 of this Report.

Shade Tree and Forest Insects.

The great abundance of the tent caterpillar, *Malacosoma americana* Fabr., and of the fall canker worm, *Alsophila pometaria* Harris, in southwestern Connecticut, as well as the lime tree winter moth, have already been mentioned under Fruit Insects. They are also pests of shade and woodland trees, and might be included here with equal appropriateness. The gipsy moth also is a pest of both fruit and shade trees, but is discussed separately on page 254 of this Report.

The fall webworm, *Hyphantria cunea* Dru., was less abundant than in 1923, except in New London County, where it was about as abundant.

The elm leaf beetle, *Galerucella xanthomelaena* Schrank (*luteola* Mull.) was a contributing cause to many brown and leafless elm trees in certain localities in central and southwestern Connecticut in August. Even some trees which had been sprayed with lead arsenate presented a pitiable condition. Of course the extreme drought aggravated this condition and new growth did not follow quickly as is the case in a moist season. All choice trees should be sprayed very carefully the coming season to prevent defoliation, as three successive and complete defoliations will usually kill a tree.

The oak leaf-roller, *Tortrix quercifoliana* Fitch, was particularly conspicuous around Stamford, where certain pin oaks were nearly defoliated, as is described on page 336.

Woolly aphids on conifers were particularly abundant in 1924, perhaps the most noticeable being the larch leaf aphid, *Chermes strobilobius* Kalt., and the one attacking Douglas fir, which is probably *Chermes cooleyi* var. *coweni* Gill. The latter was unusually common, was sent to the Station several times, and the members of the staff observed it widely. Spraying with nicotine solution and soap is a remedy.

The arbor vitae leaf-miner, *Argyresthia thuiella* Pack., was not particularly injurious in 1924, yet some of its work could be seen here and there about the State. Twigs received from Pomfret, July 5, had the leaves partially mined by this insect.

The larch leaf-miner or case bearer, *Coleophora laricella* Hubn., was somewhat in evidence, though not so destructive as in 1923.

The leopard moth, *Zeuzera pyrina* Linn., though not so destructive to trees along the coast as a few years ago, has spread inland and is the cause of considerable injury. The writer saw in Hartford during the winter many branches which had broken

from the trees on account of having been weakened by the large burrows of the larvae of this insect. Material has also been received from New Haven and Highwood during the season.

Sawfly larvae were rather more abundant than usual on pines, causing some defoliation.

The birch leaf skeletonizer, *Bucculatrix canadensisella* Chambers, was generally less abundant than in 1923, but there were portions of the State where locally the gray birches were brown in September.

One event of the season was the recognition of a European sawfly, *Fenusa pumila* Klug.,which has apparently become established in this country and which is a leaf-miner on the terminal leaves of gray birch.

Evidence was also obtained to show that the European pine shoot moth, *Evetria buoliana* Schiff., occurs in Connecticut.

The bronze birch borer, *Agrilus anxius* Gory, continues to kill European cut-leaf white birches throughout the State.

The juniper webworm, *Dichomeris* (*Ypsolophus*) *marginellus* Fabr., was received from New Canaan, June 19.

Miscellaneous Insects.

The European fly, *Muscina pascuorum* Meigen, which appeared in New England in 1922*, and which was rather abundant in Connecticut in 1923, was not seen at all around the Station laboratory in 1924. Plans were made for Mr. Friend to work out the life history of this fly, but as no material could be obtained, the plans were suspended.

Another instance was brought to our attention of a nuisance caused by the presence in greenhouses at Rowayton, of large number of the tropical cockroach, *Pycnoscelus surinamensis* Linn. (See Notes on Miscellaneous Insects.)

The biting dog louse, *Trichodectes latus* Nitzsch, (order Mallophaga) was received from Pomfret, this being the first record of the species in Connecticut.

Defoliation of honeysuckle shrubs and vines was caused by sawflies, *Abia americana* Cress., and of Rudbeckia, "golden glow", by some other species of sawfly which has not yet been identified with certainty.

Ants were very abundant everywhere during 1924, and many complaints were received of ants in houses, of ants injuring vegetable and flowering plants in gardens, and of ants infesting lawns. In each case a copy of Bulletin of Immediate Information No. 17, "Control of Ant Invasions", was sent and in several instances the Federal formula for poison bait given on page 4, was used with success.

* Report of this Station for 1922, page 373.

Convention of Entomological Workers.

As there are now several entomologists employed at this Station, and several field foremen on gipsy moth work, several Federal men in the State on gipsy moth and European corn borer control, teachers of entomology in Yale University and the Connecticut Agricultural College, and several amateur entomologists, it was thought desirable to bring them all together for a conference. Consequently they were invited to meet at the Station on October 31, 1924. Dr. Britton was elected Chairman of the meeting and additional talks were given by Mr. D. J. Caffrey, a former Assistant at the Station, now in charge of the Federal European Corn Borer Laboratory, Arlington, Mass., and by Mr. S. S. Crossman of the Federal Parasite Laboratory, Melrose Highlands, Mass., who has made several trips to Europe in search of gipsy moth parasites. The following program was arranged and carried out, not a single speaker being absent.

PROGRAM.

A.M.

10.00 Words of Welcome, W. L. Slate, Jr., New Haven
10.05 Entomological Work of the Station, W. E. Britton, New Haven
10.15 Some Animal Parasites, G. H. Lamson, Jr., Storrs
10.30 The Asiatic Beetle in Connecticut, M. P. Zappe, New Haven
10.45 Teaching Entomology in Connecticut Institutions:
Connecticut Agricultural College, J. A. Manter, Storrs
Yale University Undergraduates, A. Petrunkevitch, New Haven
Yale University School of Forestry, W. R. Coe, New Haven
11.30 Opportunities for Beekeeping in Conn., L. B. Crandall, Storrs
12.00 Oriental Peach Moth in Conn., Philip Garman, New Haven
12.30 Luncheon.

P.M.

1.45 Some Baits Attractive to Cabbage Maggot Flies,
R. B. Friend, New Haven.
2.00 Hints on Photographing Insects, B. H. Walden, New Haven
2.15 Gipsy Moth Work in Connecticut in 1924,
J. T. Ashworth, Danielson
2.45 Status of the Gipsy Moth in the United States,
A. F. Burgess, Melrose Highlands, Mass.
3.30 The European Corn Borer in the United States,
L. H. Worthley, Arlington, Mass.
4.15 Anti-Mosquito Work in Connecticut in 1924,
R. C. Botsford, New Haven

Messrs. Zappe, Friend, Walden, Garman and Botsford illustrated their talks by lantern slides.

There were a number of opinions expressed, all to the effect that the meeting had been a success and a hope that other meetings may be held in the future. About 60 were present as follows: Mr. and Mrs. A. F. Burgess, A. F. Burgess, Jr., C. W. Collins, H. L. Blaisdell, S. S. Crossman, Melrose Highlands, Mass.; L. H. Worthley, D. J. Caffery, R. A. Vickery, T. M. Cannon, Arlington, Mass.; Mr. and Mrs. Albert Hartzell, Yonkers, N. Y.; H. C. Huckett, Riverhead, N. Y.; H. J. Evans, Mineola, N. Y.; D. G. Murphy, Pittsfield, Mass.; H. A. Ames, Bound Brook, N. J.; Professors Alexander Petrunkevitch and W. R. Coe, Yale University, New Haven, Conn.; Professors G. H. Lamson, Jr., J. A. Manter, L. B. Crandall, A. J. Grady, T. F. Cronin, V. A. Johnson, J. W. Balock, Storrs, Conn.;

F. C. Rich, Ansonia, Conn.; W. A. Collins, New Milford, Conn.; J. J. Pillsbury, Burnside, Conn.; Professor Pauline H. Dederer, Connecticut College for Women, New London, Conn.; S. E. May, Canaan, Conn.; P. H. Meagher, Wallingford, Conn.; John T. Ashworth, J. W. Longo, A. J. Gilbert, H. A. Woodmancy, H. E. Cook, O. B. Cooke, C. M. Spencer, Danielson, Conn.; Dolor LaBelle, Ballouville, Conn.; James A. McEvoy, Putnam, Conn.; A. W. Yates, Hartford, Conn.; H. W. Coley, Westport, Conn.; E. J. Smith, Clintonville, Conn.; Mr. and Mrs. Henry S. Woolley, Waterbury, Conn.; P. L. Buttrick, New Haven, Conn.; Robert E. O'Brien, New Haven, Conn.; and Messrs W. L. Slate, Jr., E. H. Jenkins, G. P. Clinton, E. M. Stoddard, G. E. Graham, Philip Garman, M. P. Zappe, B. H. Walden, R. C. Botsford, R. B. Friend, Leslie Rogers and W. E. Britton of the Agricultural Experiment Station, New Haven, Conn.

INSPECTION OF NURSERIES IN 1924.

The annual inspection of growing nursery stock was begun July 25, and was finished October 14, except for one plantation inspected December 30. This work was in charge of Mr. M. P. Zappe, and was conducted about the same as in 1923, except that Mr. W. R. Hunt of the Botany Department assisted and was present during the inspection of all the larger nurseries. Consequently more attention could be given to plant diseases than heretofore. The work was done by Messrs. Zappe, Friend, Hunt, Cronin and Rogers. Mr. Ahearn inspected one strawberry nursery and Dr. Britton helped inspect two nurseries. Two nurseries were inspected in the spring and again at the time of the annual inspection.

In addition to the inspections made from this office, the gipsy moth scouts were instructed to make careful inspections for gipsy moth eggs in and around nurseries, and to have it reported to the office in case any were found.

In 33 nurseries, no important pests were found. Following is a list of insects and plant diseases found in nurseries, together with the number of nurseries infested by each, as taken from the inspection reports on file in the office:

List of Pests Found in Nurseries in 1924

Nurseries uninfested 33

INSECTS

Aphids, apple, green	7	Curculio, poplar	1
woolly	5	Elm leaf beetle	1
pine bark	3	Fall webworm	4
spruce gall,		Lace bugs, on rhododendron	3
Chermes abietis	40	Leopard moth larva	1
cooleyi	12	*Laspeyresia molesta*	6
Apple and thorn skeletonizer	2	Leaf hoppers, on apple	4
Birch Bucculatrix	4	Mite, European red	2
Birch leaf-miner	1	pear blister	4
Borer, lilac	2	*Papaipema* larva	1
locust	1	Red humped caterpillar	2
poplar	1	Sawfly, *Diprion simile*	2

INSECTS—*concluded.*

Sawfly, larch	1	Scale, San José	32
Scale, elm	8	scurfy	2
euonymus	1	tulip tree	6
lecanium	1	West Indian peach	1
oak	1	white elm	1
oak gall scale (*Kermes*)	1	on *Juglans*	1
oyster-shell	44	White pine weevil	5
pine leaf	5	White grub in seed beds (*Abies*)	1
rose	6	White grub in Multiflora roses	1

PLANT DISEASES

Apple scab	12	Mildew on cherry	1
Black knot	1	cornus	1
Brown rot	4	grapes	6
Canker on apricot	1	lilac	2
horsechestnut	1	peaches	1
nectria	2	roses	15
poplar	25	snowdrop	1
sycamore	1	Mosaic, raspberry	8
Crown gall	3	Rust on ash	1
Fire blight	1	blackberry	1
Leaf spot on roses	2	white pine blister, (on Ribes)	8
Mildew on apples	5	cedar (on apple)	15
catalpa	3		

From the preceding list it may be seen that the oyster-shell scale is still the commonest pest found in Connecticut nurseries, and was found in 44 different nurseries. The next commonest is the spruce gall aphid, 40 nurseries. Next in order is the San José scale, 32 nurseries. Following these comes a fungus, the poplar canker, 25 nurseries.

In order to show how the figures of 1924 correspond with those obtained in preceding years, the following table gives the figures as reported by the inspectors for the past seven years.

SEVEN YEAR RECORD OF SERIOUS AND COMMON NURSERY PESTS.

Pest	1918	1919	1920	1921	1922	1923	1924
Oyster-shell scale	39	38	38	36	44	42	44
San José scale	18	19	11	28	19	20	32
Spruce gall aphid	15	19	21	31	21	28	40
White pine weevil	5	5	1	1	19	17	5
Apple and thorn skeletonizer	..	..	...	..	1	18	2
Poplar canker	6	5	13	21	31	34	25
Blister rust (on Ribes)	1	..	..	2	9	6	8
No pests	32	32	46	36	36	32	33

It may be seen from the figures given in the table above that the oyster-shell scale (44) is, and has been for the past seven years, the most common pest found in nurseries. In 1924, the pests which were the next commonest are the spruce gall aphid (40), the San José scale (32), and the poplar canker (25). Then follows the pine blister rust which was found in eight nurseries, in all cases on the leaves of *Ribes*. The apple and thorn skeleton-

izer was found in two nurseries in 1924 as against 18 nurseries in 1923. Brief accounts of three of these major pests were given in the Report of this Station for 1923 (Bulletin 256), page 240.

Number of Nurseries.

During the year, 122 regular nurseries have been inspected, and 118 certificates granted. Since last year, eight nurseries have gone out of business, three have changed firm names, and 18 new nurseries have been started. Two nurseries were inspected in the spring and certificates issued, and again examined and certificated at the time of the regular inspection. Besides these inspections, 109 separate parcels of nursery stock were inspected and certificates furnished; also 116 duplicate certificates were furnished for filing in other States.

The total area of Connecticut nurseries in 1924 is 1,779 acres, and the nurserymen's list contains 116 names, as follows:

Nursery Firms in Connecticut Receiving Certificates in 1924

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Barnes Bros. Nursery Co.	Yalesville	150	Aug. 30	1490
Barnes Nursery & Orchard Co.	Wallingford	45	Oct. 1	1519
Barton Nursery	Hamden	1	Oct. 9	1541
Beattie, Wm. H.	New Haven	1	Oct. 2	1527
Benbow, A.	Norfolk	1	Oct. 15	1547
Berkshire Nurseries (C. B. Myers, Prop.)	Milford	6	Oct. 23	1553
Bertolf Brothers	Greenwich	25	Sept. 17	1508
Brainard Nursery & Seed Co.	Thompsonville	10	Sept. 13	1502
Braley & Co.	Burnside	1	Aug. 28	1487
Bretschneider, A.	Danielson	1	Sept. 10	1498
Bristol Nurseries, Inc	Bristol	16	Oct. 7	1539
Burr & Co., C. R.	Manchester, Ellington and Durham	500	Aug. 20	1476
Burroughs, Thos. E.	Deep River	3	Sept. 2	1491
Chapman, C. B.	Groton	1	Sept. 12	1499
Chapman, C. E.	No. Stonington	2	Sept. 18	1509
Clinton Nurseries (Warren Richards, Mgr.)	Clinton	1	Oct. 8	1540
Coari, Louis (2)	Southport	6	Sept. 30	1518
Conine Nursery Co	Stratford	50	Sept. 12	1501
Conn. Agricultural College (Prof. S. P. Hollister)	Storrs	1	Aug. 19	1473
Conn. Agr. Exp. Sta. (W. O. Filley, Forester)	New Haven	2	Oct. 6	1536
Crofut & Knapp Farm	Norwalk	20	Dec. 31	1583
Cross Highway Nurseries	Westport	6	Dec. 31	1580
Dallas, Inc., Alexander	Waterbury	1	Nov. 13	1563
Dawson's Nursery	Willimantic	2	Sept. 20	1511
De Wyn, Peter	Yalesville	1	Aug. 22	1481
Dowd, Inc., F. C.	Madison	1	Sept. 3	1493
Dunlap, Daniel S.	Cromwell	1	Sept. 16	1504
East Rock Nursery (J. Palmeri, Prop.)	New Haven	1	Oct. 6	1535

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1924—*Con.*

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Edgewood Nursery, Vidal,Inc.	Stamford	5	Nov. 5	1560
Eells, Wm. W.	Manchester	1	Sept. 9	1497
Elm City Nursery Co., Woodmont Nurseries, Inc.	Woodmont and New Haven	155	Sept. 6	1495
Evergreen Nursery Co.	Wilton	10	Aug. 27	1482
Fairty, C. H.	New Canaan	1	Dec. 1	1572
Fraser, G. W.	Willimantic	1	Aug. 19	1474
Gardner's Nurseries.	Rocky Hill	8	Sept. 16	1506
Geduldig's Greenhouses	Norwich	1	Sept. 27	1514
Glenn Terrace Ornamental Nursery (James H. Everett, Prop.)	Mount Carmel	10	Dec. 1	1573
Heath & Co.	Manchester	5	Aug. 19	1471
Hilliard, H. J.	Sound View	1	Dec. 24	1577
Hiti Nurseries (J. H. Bowditch, Prop.)	Pomfret Center	9	Aug. 20	1475
Holcomb, Irving	Simsbury	1	Sept. 5	1494
Holdridge, S. E.	Ledyard	2	Dec. 31	1585
Hoogendoorn, C.	Yalesville	1	Aug. 22	1480
Horan & Son, Jas.	Bridgeport	1	Oct. 29	1559
Houston's Nurseries	Mansfield	4	Nov. 7	1562
Hoyt's Sons Co., Inc., The Stephen	New Canaan	250	Sept. 16	1507
Hull, Curtis M.	Wallingford	1	Oct. 24	1554
Hunt & Co., W. W.	Hartford	10	Oct. 4	1533
Isselee, Charles.	Darien	10	Nov. 15	1564
Jones, William	Norwalk	1	Oct. 2	1524
Kelley, James J.	New Canaan	1	Nov. 28	1569
Kellner, Herman H.	Danbury	1	Oct. 1	1522
Keso Nursery (J. J. Kelsey, Prop.)	Clinton	1	Nov. 24	1568
Leghorn, John J.	Cromwell	1	Sept. 16	1505
Long Hill Nursery	Burnside	1	Dec. 22	1576
Mallett Co., George A.	Bridgeport	1	Oct. 14	1545
Maplewood Nurseries (T. H. Peabody, Mgr.)	Norwich	1	Oct. 3	1531
Marigold Farm (H. Kelley, Prop.)	New Canaan	6	Nov. 24	1567
Meier, A. R.	West Hartford	1	Oct. 25	1555
Millane Tree Expert Co., The	Middletown	1	Nov. 18	1565
New Haven Florist Co.	New Haven	1	Dec. 30	1579
New Haven Nurseries, The.	New Haven	1	Aug. 28	1485
New Haven Park Commissioners (G. X. Amrhyn, Supt.)	New Haven	30	Aug. 28	1486
Newington Gardens.	Newington	1	Oct. 2	1526
New London Cemetery Association (Ernest E. Rogers, Pres.)	New London	1	Oct. 3	1532
New London County Nurseries(W. J. Schoonman,Prop)	New London	5	Oct. 7	1538
New London Greenhouses and Nursery	New London	1	Oct. 21	1550
New Milford Nurseries	Northville	1	Sept. 30	1517
Nicolson & Thurston (2)	Litchfield	1	Oct. 15	1548
North-Eastern Forestry Co.	Cheshire	20	Aug. 14	1470
Norwood Nursery	Hamden	1	Oct. 6	1537
Oakland Nurseries	Manchester	5	Aug. 20	1477

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1924—*Con.*

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Outpost Nurseries (L. D. Conley, Prop.)	Ridgefield	25	Sept. 25	1513
Ouwerkerk & Van der Stam.	Yalesville	7	Aug. 22	1479
Park Gardens	Bridgeport	1	Oct. 1	1521
Park Hill Flower Shop	Manchester	1	Sept. 9	1496
Pequod Nursery Co.	Yalesville	15	Aug. 27	1483
Phelps & V. T. Hammer Co., The J. W.	Branford	2	Oct. 11	1544
Pierson, A. N., Inc.	Cromwell	75	Aug. 22	1478
Polish Orphanage Farm (Rev. L. Bojnowski, Mgr.)	New Britain	1	Oct. 14	1546
Pomeroy, Edwin C.	Northville	1	Sept. 30	1516
Reck, Julius	Bridgeport	1	Nov. 28	1570
Reumann, Theodore	Stamford	1	Oct. 1	1520
Rockfall Nursery Co. (P. Marotta, Prop.)	Rockfall	40	Sept. 27	1515
Rowayton Greenhouses	Rowayton	1	Sept. 16	1503
Ryther, O. E.	Norwich	6	Nov. 5	1561
Saxe & Floto	Waterbury	1	Dec. 31	1584
Scheepers, Inc., John.	Stamford	6	Dec. 13	1575
Scott, J. W.	Hartford	5	Dec. 2	1574
Sierman, C. H.	Hartford	5	Oct. 27	1557
South Wilton Nurseries	South Wilton	6	Nov. 19	1566
Stamford Seed & Nursery Co.	Stamford	1	Oct. 2	1525
Stannard Hill Greenhouse	Westbrook	1	Aug. 29	1488
Steck, Charles A.	Newtown	5	Oct. 28	1558
Steck, Mrs. Sarah B.	Bethel	1	Oct. 21	1551
Stratfield Nursery Co.	Bridgeport	10	Dec. 31	1581
Stratford Florist Co. (C. A. Cooper)	Stratford	1	Oct. 1	1523
Stratford Rose Nurseries (John Barrow, Prop.)	Stratford	1	Oct. 2	1530
Sunny Ridge Nursery (Charles A. Steck, Jr.)	Bethel	5	Oct. 2	1528
Tanner's Nursery Co.	Manchester	1	Aug. 27	1484
Tow Path Gardens (S. W. Eddy, Prop.)	Avon	1	Oct. 27	1556
Upson, R. E.	Marion	1	Oct. 9	1542
Vanderbrook & Son, Chas. L.	Manchester	5	Aug. 19	1472
Van Wilgen & Co.	Branford	15	Oct. 21	1552
Vasileff, Nicholas	Greenwich	1	Dec. 31	1582
Verkade's Nurseries	New London	20	Sept. 12	1500
Vidbourne & Co., Estate of J.	Hartford	3	Nov. 28	1571
Wallace Nursery	Wallingford	4	Sept. 2	1492
Wheeler, Chas. B.	No. Stonington	1	Oct. 6	1534
Wilcox, Harry D.	Avon	1	Oct. 2	1529
Wild, Henry	Greenwich and Norwalk	16	Sept. 25	1512
Wilson & Co., C. E.	Manchester	50	Sept. 19	1510
Woodruff, C. V.	Orange	1	Oct. 9	1543
Yale University School of Forestry	New Haven	1	Oct. 18	1549
Young, Mrs. Nellie A.	Pine Orchard	1	Dec. 27	1578
Zack, Co., H. J.	Deep River	4	Aug. 29	1489
Total acreage		1,779		

Inspection of Raspberry Plantations.

In addition to the inspection of nursery stock, some fruiting plantations were examined to ascertain whether or not they were free of the disease known as mosaic. This disease is not very well understood and its cause is not definitely known, but has at different times and by various investigators been supposed to be an enzyme or chemical ferment, and an ultra-microscopic germ or organism of bacterial or protozoan nature. Whatever may be the cause, it is fairly well established that it is transmitted by a small species of aphid, *Aphis rubiphila* Patch. This makes it somewhat analogous to the mosaic of potato which is transmitted by the potato aphid, *Macrosiphum solanifolii* Ashm.

Recently an attempt has been made in New York State to grow raspberry plants which are free from mosaic, and nurserymen are not allowed to ship raspberry plants into New York State unless some similar method of inspection and eradication is in practice in the State where the stock is grown. Similar action has been taken by the States of Ohio, Michigan and Minnesota. Consequently there were several applications for inspections on account of this disease, some from regular nurserymen, and others from owners of fruiting raspberry plantations.

As this problem required the co-operation of the Botanical and Entomological Departments, arrangements were made to visit New York State and learn the status of the raspberry inspection and the eradication of mosaic. By appointment, Messrs. Clinton and Hunt, Botanists, and Britton and Zappe, Entomologists, visited Poughkeepsie and Highland, N. Y., on July 10, where Dr. W. H. Rankin showed his work and gave the visitors all the information on the subject at his command. Evidently some varieties are much more susceptible to the disease than others, and it seems to be a difficult matter to grow the standard varieties of red raspberries and have them free from mosaic. The everbearing varieties, though not immune, are not commonly affected, and the black-caps and purple canes are not or almost never attacked. Blue stem and curly leaf are two other troubles apparently distinct from mosaic, though not well understood. The former is a disease of black-caps and the latter is found on red raspberries as well as is mosaic, though less common.

Shortly after returning to Connecticut, some inspections of raspberry plantations were made by Messrs. Zappe, Clinton and Hunt, beginning July 16 and extending through the regular inspection of nurseries. In a portion of the plantations of certain varieties, if much mosaic occurred, the owner expressed a desire to destroy the plants and not attempt to obtain a certificate. Certain other varieties were free or nearly free from mosaic and the diseased plants were removed or "rogued out" and a second inspection made a month or six weeks later. Thus it was possible

to grant certificates on certain varieties where it had to be refused on other varieties. Altogether, eight plantations were inspected and five special certificates granted. These certificates were signed by both the Botanist and the Entomologist. The list of growers receiving special raspberry certificates is as follows:

SPECIAL CERTIFICATES ON RASPBERRY PLANTS.

Name of Firm	Address	Variety	Certificate Issued	No. of Certificate
Barnes Bros. Nursery Company	Yalesville (Durham plantation)..	La France Latham King Red Path...	Oct. 10	3
Barnes Nursery and Orchard Company..	Wallingford...	Erskine Park St. Regis...	Oct. 10	4
Bertolf Brothers.....	Greenwich....	La France..	Oct. 10	5
Croteau, Fannie.....	Mount Carmel	St. Regis...	Sept. 15	1
Scheepers, Inc., John..	Stamford.....	La France..	Oct. 10	2

INSPECTION OF IMPORTED NURSERY STOCK.

The nursery stock imported from foreign countries and entering Connecticut during 1924 was inspected as in preceding years, mostly by Mr. Zappe, but assisted by Messrs. Botsford, Friend, Rogers and Walden. Though the number of shipments was slightly less than last year, there was an increase of about 75 per cent. in the number of cases and 71 per cent. in the number of plants. The following table shows the number of shipments, number of cases, and number of plants, inspected at destination, during each of the last five years:

Year	No. of Shipments	No. of Cases	No. of Plants
1920.....	17	87	814,491
1921.....	21	126	1,228,560
1922.....	30	159	1,997,595
1923.....	35	179	1,981,895
1924.....	33	313	3,489,170

These 33 shipments were imported by eight different Connecticut firms, 24 of them being consigned to two firms. Most of the stock consisted of seedling fruit and Manetti rose, for grafting and budding. There were 14 shipments of fruit seedlings, and 19 shipments of rose stocks; two shipments contained both fruit and rose stocks.

The cost of inspecting this imported nursery stock was about $500.00.

As in preceding years, the bulk of the shipments came from France and Holland, with a few shipments from England and other countries. The sources of this stock inspected during the year were as follows:

SOURCES OF IMPORTED NURSERY STOCK, 1923-1924.

Country	No. of Shipments	No. of Cases	No. of Plants
France	13	164	2,033,600
Holland	12	119	1,126,070
England	6	21	259,500
Italy	1	2	10,000
Germany	1	7	60,000
	33	313	3,489,170

The following table shows the quantities of stock as inspected by months:

Month	No. of Shipments	No. of Cases	No. of Plants
November	2	5	105,000
December	4	25	229,500
January	6	66	720,820
February	17	174	1,984,900
March	4	43	448,950
	33	313	3,489,170

In addition to the material tabulated above, there were 13 shipments containing 16 packages of seeds, mostly of trees and palms, which were not inspected in Connecticut.

Of the 33 shipments of stock inspected, 17 shipments or 49 per cent. were found infested with insects or plant diseases, though most of them were not dangerous pests. Details regarding these pests are given below.

PESTS FOUND ON IMPORTED NURSERY STOCK.

17 Shipments Infested.

INSECTS.

Emphytus cinctus Linn., on Manetti rose. (15 shipments). S. Bide & Son, Ltd., Farnham, Surrey, England; W. Fromow & Sons, Windlesham, Surrey, England; W. C. Slocock, Woking, England; B. Ruys, Ltd., Dedensvaart, Holland; Franco-American Seedling Co., Angers, France; Georges Benard, Olivet-Orleans, France; Oudyh Brothers Nurseries, Boskoop Holland; Association Flora, Boskoop, Holland; H. K. Woldering, Veendam, Holland; M. Gielen, Oudenbosch, Holland; V. Levasseur & Sons, Ussy, Calvados, France; D. J. de Jonge, Sappemeer, Holland. On Fruit stock, Andre Choplin, Maze, France.

Lepidopterous pupae on apple. (3 shipments.) Andre Choplin, Maze, France; Franco-American Seedling Co., Angers, France. On Quince, Louis Leroy's Nurseries, Angers, France.

Notolophus antiqua Linn., on apple (1 shipment.) Franco-American Seedling Co., Angers, France.

PLANT DISEASES.

Crown Gall on Manetti rose. (4 shipments.) W. C. Slocock, Woking, England. On fruit stock, Andre Choplin, Maze, France; Franco-American Seedling Co., Angers, France.

INSPECTION OF APIARIES IN 1924.

In 1924, as in past years, the apiary inspection work has been done by Messrs. H. W. Coley of Westport and A. W. Yates of Hartford on a *per diem* basis. Mr. Coley covers the southern half of the State, comprising Fairfield, New Haven, Middlesex and New London Counties. Mr. Yates covers the northern half, composed of Litchfield, Hartford, Tolland and Windham Counties.

This work required a total of 159 man days and the entire cost for the season was $2,306.40.

More apiaries and more colonies were inspected in 1924 than have ever before been inspected in a single season. The following table shows the number of apiaries and colonies inspected, and the average number of colonies per apiary for each year since the inspection work was commenced in 1910.

FIFTEEN YEAR RECORD OF APIARY INSPECTION IN CONNECTICUT.

Year	No. of Apiaries	No. of Colonies	Average No. Colonies per Apiary	Cost of Inspection Per Apiary	Per Colony
1910	208	1,595	7.6	$2.40	.28
1911	162	1,571	9.7	1.99	.21
1912	153	1,431	9.3	1.96	.21
1913	189	1,500	7.9	1.63	.21
1914	463	3,882	8.38	1.62	.19
1915	494	4,241	8.58	1.51	.175
1916	467	3,898	8.34	1.61	.19
1917	473	4,506	9.52	1.58	.166
1918	395	3,047	7.8	1.97	.25
1919	723	6,070	11.2	2.45	.29
1920	762	4,797	6.5	2.565	.41
1921	751	6,972	9.2	2.638	.24
1922	797	8,007	10.04	2.60	.257
1923	725	6,802	9.38	2.55	.27
1924	953	8,929	9.4	2.42	.25

In 1924, apiaries were inspected in 142 towns as against 119 towns in 1923, and 125 towns in 1922.

For the first time an inspection was made in the town of Union, as the inspector heretofore had been unable to learn of any bees in that town. On account of the law compelling registration, he obtained this information and made the inspection. However, it was only one apiary containing two colonies of bees.

In 1924 inspections were made in the following 35 towns not visited in 1923: *Fairfield County*: Brookfield, Ridgefield and Weston; *New Haven County*: East Haven, New Haven, North Branford, Wolcott and Woodbridge; *Middlesex County*: Portland and Westbrook; *New London County*: Colchester, Griswold, Ledyard, Lisbon, North Stonington, Salem, Sprague and Voluntown; *Litchfield County*: Bridgewater, Canaan, Cornwall, New Milford, Norfolk, North Canaan, Roxbury, Salisbury and Sharon; *Hartford*

County: Avon and Hartland; *Tolland County*: Stafford, Tolland, Union and Willington; *Windham County*: Ashford and Thompson.

In 1923, apiaries were inspected in the following 13 towns not visited in 1924: *Fairfield County*: Bethel; *Middlesex County*: Saybrook; *Litchfield County*: Harwinton and New Hartford; *Hartford County*: Bloomfield, East Granby, East Windsor, Granby, Suffield, Windsor and Windsor Locks; *Tolland County*: Bolton and Hebron.

European Foul Brood.

This disease is caused by *Bacillus pluton* which attacks and kills the young larvae in the cells, being more destructive in spring and early summer than in other seasons. The odor of fermentation is usually present but it is not very offensive and the contents of the cells are usually not gelatinous or ropy. The common remedy consists of requeening with Italian queens and having the colonies strong by uniting if necessary.

Of the 953 apiaries, and 8,929 colonies inspected in 1924, 17 apiaries and 47 colonies were found infested with European foul brood. This is 1.78 per cent. of the apiaries and .526 per cent. of the whole number of colonies inspected during the season. Though the percentage of colonies infested is somewhat larger than 1923, the percentage of infested apiaries is smaller than ever before. In fact this disease has shown almost a gradual reduction, due we believe to the system of inspection and better handling of apiaries, since the inspection work began in 1910, as the following table will show:

Record of European Foul Brood.

Year	Percentage of Infestation	
	Apiaries	Colonies
1910	75.9	49.7
1911	51.8	27.4
1912	47.7	23.5
1913	44.4	24.5
1914	32.6	13.9
1915	26.1	10.3
1916	18.8	7.05
1917	16.7	4.86
1918	9.8	3.3
1919	6.6	1.2
1920	4.3	1.5
1921	3.99	1.26
1922	4.14	.85
1923	2.34	.36
1924	1.78	.526

During 1924, European foul brood was found only in Meriden and Waterbury, New Haven County; Durham and East Hampton, Middlesex County; Lebanon, Old Lyme, Salem and Stoning-

ton, New London County; Barkhamsted, Cornwall and Roxbury, Litchfield County; Hartland, Hartford County; Ellington, Tolland County; Brooklyn, Plainfield, Putnam and Sterling, Windham County. This disease was not found in any of the apiaries inspected in Fairfield County.

American Foul Brood.

American foul brood is also a bacterial disease caused by *Bacillus larvae,* and attacks the brood at a later stage than European foul brood. It usually shows itself at the time the larvae are mature and pupating, when the cells are sealed or capped. The diseased cells later become sunken and if broken open the contents emit an offensive odor, and have a peculiar stringy or ropy consistency. Shaking into clean hives, destroying all infected combs and disinfecting the old hives is the treatment. Almost the whole danger of a recurrence is careless treatment and reinfection from infected combs and honey. Some authorities are recommending and using an alcohol-formalin solution containing 20 per cent. formalin, in which they soak the combs to sterilize them, after which they can be safely used. This may prove of great value in stamping out the disease.

Of the 953 apiaries and 8,929 colonies inspected in 1924, 10 apiaries and 20 colonies were found diseased with American foul brood. This is 1.04 per cent. of the apiaries and .22 per cent. of the colonies, a slight increase in percentage of the apiaries and decrease in that of the colonies over last year. With American foul brood there has never been any gradual decrease as in the case of European foul brood, but spasmodic outbreaks have occurred here and there since 1914. The following table will show the percentages of apiaries and colonies found diseased with American foul brood since the beginning of inspection work in Connecticut.

Record of American Foul Brood.

Year	Percentage of Infestation Apiaries	Colonies
1910	0	0
1911	0	0
1912	0	0
1913	0	0
1914	1.07	.7
1915	.8	.18
1916	1.07	.15
1917	.42	.17
1918	1.01	.32
1919	3.	1.1
1920	1.18	.25
1921	2.5	.56
1922	1.38	.27
1923	.965	.323
1924	1.04	.22

During 1924, American foul brood was found in the towns of Greenwich and Shelton, Fairfield County; Naugatuck and Wallingford, New Haven County; Clinton, East Hampton and Haddam, Middlesex County; Old Lyme, New London County; Thomaston and Washington, Litchfield County. The disease was not found in any apiaries inspected during the season in Hartford, Tolland or Windham Counties.

The system of controlling this disease in some of the States is that known as the "area clean-up" method, and an attempt is made to eradicate the disease, working around the centers of infection. A movement has been started to procure Federal co-operation in this work.

Statistics of Inspection.

The statistics of apiary inspection by towns and counties may be found on the following pages, with summary on page 252.

Towns	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased	American Foul Brood	European Foul Brood	Sacbrood	Paralysis
Fairfield County:								
Brookfield	4	0	56	0	0	0	0	0
Danbury	5	0	29	0	0	0	0	0
Darien	6	2	61	3	0	0	3	0
Easton	4	1	181	1	0	0	1	0
Fairfield	10	1	104	1	0	0	1	0
Greenwich	9	1	54	1	1	0	0	0
Monroe	4	0	88	0	0	0	0	0
New Canaan	5	0	63	0	0	0	0	0
Newtown	10	1	115	1	0	0	1	0
Norwalk	4	0	37	0	0	0	0	0
Redding	3	0	22	0	0	0	0	0
Ridgefield	6	1	22	1	0	0	1	0
Shelton	3	1	47	2	2	0	0	0
Stamford	21	0	187	0	0	0	0	0
Stratford	2	0	14	0	0	0	0	0
Trumbull	4	0	57	0	0	0	0	0
Weston	2	0	11	0	0	0	0	0
Westport	5	0	26	0	0	0	0	0
Wilton	12	0	161	0	0	0	0	0
	119	8	1,335	10	3	0	7	0
New Haven County:								
Beacon Falls	3	0	52	0	0	0	0	0
Branford	3	0	12	0	0	0	0	0
Cheshire	8	0	71	0	0	0	0	0
Derby	3	1	16	1	0	0	1	0
East Haven	2	0	22	0	0	0	0	0
Guilford	5	0	59	0	0	0	0	0
Hamden	8	0	107	0	0	0	0	0
Madison	3	1	32	1	0	1	0	0

APIARIES INSPECTED IN 1924—*Continued.*

Towns	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased	American Foul Brood	European Foul Brood	Sacbrood	Paralysis
New Haven County: —*Concluded.*								
Meriden	25	2	208	2	0	0	2	0
Milford	5	0	69	0	0	0	0	0
Naugatuck	6	2	19	2	1	0	1	0
New Haven	3	0	14	0	0	0	0	0
North Branford	2	0	50	0	0	0	0	0
North Haven	11	1	158	2	0	0	2	0
Orange	2	0	10	0	0	0	0	0
Prospect	9	0	79	0	0	0	0	0
Seymour	1	0	10	0	0	0	0	0
Wallingford	23	6	145	8	4	0	4	0
Waterbury	10	1	71	2	0	2	0	0
West Haven	3	0	30	0	0	0	0	0
Wolcott	2	0	7	0	0	0	0	0
Woodbridge	2	1	27	1	0	0	1	0
	139	15	1,268	19	5	3	11	0
Middlesex County:								
Chester	5	0	48	0	0	0	0	0
Clinton	8	5	71	20	2	0	18	0
Cromwell	7	0	37	0	0	0	0	0
Durham	7	2	136	2	0	1	1	0
East Haddam	7	0	172	0	0	0	0	0
East Hampton	10	2	117	2	1	1	0	0
Essex	4	0	67	0	0	0	0	0
Haddam	4	2	50	5	5	0	0	0
Killingworth	7	1	38	4	0	0	4	0
Middlefield	3	0	91	0	0	0	0	0
Middletown	10	0	104	0	0	0	0	0
Old Saybrook	6	1	67	2	0	0	2	0
Portland	8	0	45	0	0	0	0	0
Westbrook	2	0	9	0	0	0	0	0
	88	13	1,052	35	8	2	25	0
New London County:								
Bozrah	3	0	112	0	0	0	0	0
Colchester	9	0	43	0	0	0	0	0
East Lyme	3	0	56	0	0	0	0	0
Franklin	1	0	24	0	0	0	0	0
Griswold	4	1	89	2	0	0	2	0
Groton	6	0	31	0	0	0	0	0
Lebanon	10	1	144	1	0	1	0	0
Ledyard	1	0	18	0	0	0	0	0
Lisbon	2	0	43	0	0	0	0	0
Montville	6	0	83	0	0	0	0	0
New London	5	0	90	0	0	0	0	0
No. Stonington	2	0	27	0	0	0	0	0
Norwich	13	1	425	2	0	0	2	0
Old Lyme	3	1	61	2	1	1	0	0
Preston	7	0	49	0	0	0	0	0
Salem	2	1	42	1	0	1	0	0
Sprague	2	0	39	0	0	0	0	0

APIARIES INSPECTED IN 1924—*Continued.*

Towns	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased	American Foul Brood	European Foul Brood	Sacbrood	Paralysis
New London County: —*Concluded.*								
Stonington	8	1	63	1	0	1	0	0
Voluntown	1	0	14	0	0	0	0	0
Waterford	7	0	52	0	0	0	0	0
	95	6	1,505	9	1	4	4	0
Litchfield County:								
Barkhamsted	4	2	41	10	0	10	0	0
Bethlehem	2	0	8	0	0	0	0	0
Bridgewater	12	0	91	0	0	0	0	0
Canaan	5	0	28	0	0	0	0	0
Colebrook	2	0	5	0	0	0	0	0
Cornwall	9	3	40	4	0	4	0	0
Goshen	3	0	29	0	0	0	0	0
Litchfield	19	0	122	0	0	0	0	0
Morris	5	0	27	0	0	0	0	0
New Milford	11	0	101	0	0	0	0	0
Norfolk	6	0	24	0	0	0	0	0
North Canaan	5	0	65	0	0	0	0	0
Plymouth	9	0	51	0	0	0	0	0
Roxbury	4	1	21	2	0	2	0	0
Salisbury	8	0	49	0	0	0	0	0
Sharon	3	0	68	0	0	0	0	0
Thomaston	12	1	39	1	1	0	0	0
Torrington	2	0	7	0	0	0	0	0
Washington	7	1	121	2	2	0	0	0
Watertown	5	1	19	2	0	0	0	2
Winchester	7	1	44	1	0	0	0	1
Woodbury	9	0	65	0	0	0	0	0
	149	10	1,065	22	3	16	0	3
Hartford County:								
Avon	3	0	4	0	0	0	0	0
Berlin	12	0	255	0	0	0	0	0
Bristol	19	0	97	0	0	0	0	0
Burlington	8	0	38	0	0	0	0	0
Canton	12	0	80	0	0	0	0	0
East Hartford	1	0	3	0	0	0	0	0
Enfield	3	0	11	0	0	0	0	0
Farmington	11	0	66	0	0	0	0	0
Glastonbury	24	0	164	0	0	0	0	0
Hartland	1	1	103	2	0	2	0	0
Manchester	10	0	70	0	0	0	0	0
New Britain	18	0	148	0	0	0	0	0
Newington	8	0	66	0	0	0	0	0
Plainville	12	1	25	2	0	0	0	2
Rocky Hill	5	0	47	0	0	0	0	0
Simsbury	8	0	37	0	0	0	0	0
Southington	14	0	80	0	0	0	0	0
South Windsor	14	0	120	0	0	0	0	0
West Hartford	26	0	168	0	0	0	0	0
Wethersfield	5	0	30	0	0	0	0	0
	214	2	1,612	4	0	2	0	2

APIARIES INSPECTED IN 1924—*Concluded.*

Towns	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased	American Foul Brood	European Foul Brood	Sacbrood	Paralysis
Tolland County:								
Andover	5	0	27	0	0	0	0	0
Columbia	3	0	15	0	0	0	0	0
Coventry	11	0	75	0	0	0	0	0
Ellington	15	3	67	4	0	4	0	0
Mansfield	4	1	46	1	0	0	0	1
Somers	3	0	19	0	0	0	0	0
Stafford	6	0	25	0	0	0	0	0
Tolland	6	0	35	0	0	0	0	0
Union	1	0	2	0	0	0	0	0
Vernon	7	0	32	0	0	0	0	0
Willington	9	0	47	0	0	0	0	0
	70	4	390	5	0	4	0	1
Windham County:								
Ashford	1	0	16	0	0	0	0	0
Brooklyn	5	1	177	1	0	1	0	0
Canterbury	3	0	26	0	0	0	0	0
Chaplin	1	0	1	0	0	0	0	0
Eastford	3	0	11	0	0	0	0	0
Hampton	7	0	78	0	0	0	0	0
Killingly	11	0	48	0	0	0	0	0
Plainfield	24	4	114	12	0	12	0	0
Pomfret	3	0	8	0	0	0	0	0
Putnam	5	1	36	1	0	1	0	0
Sterling	3	1	11	2	0	2	0	0
Thompson	4	0	47	0	0	0	0	0
Windham	6	0	84	0	0	0	0	0
Woodstock	3	0	45	0	0	0	0	0
	79	7	702	16	0	16	0	0

SUMMARY.

County	No. Towns	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased	American Foul Brood	European Foul Brood	Sacbrood	Paralysis
Fairfield	19	119	8	1,335	10	3	0	7	0
New Haven	22	139	15	1,268	19	5	3	11	0
Middlesex	14	88	13	1,052	35	8	2	25	0
New London	20	95	6	1,505	9	1	4	4	0
Litchfield	22	149	10	1,065	22	3	16	0	3
Hartford	20	214	2	1,612	4	0	2	0	2
Tolland	11	70	4	390	5	0	4	0	1
Windham	14	79	7	702	16	0	16	0	0
	142	953	65	8,929	120	20	47	47	6

	No. Apiaries	No. Colonies
Inspected	953	8,929
Infested with European foul brood	17	47
Per cent. infested	1.78	.526
Infested with American foul brood	10	20
Per cent. infested	1.04	.22
Sacbrood	17	47
Bee paralysis	4	6
Average number of colonies per apiary		9.4
Cost of inspection		$2,306.40
Average cost per apiary		2.42
Average cost per colony		.25

Registration of Bees.

There is still much confusion regarding the registration of bees, and many beekeepers are not complying with the law. Some beekeepers think that if they register once, they need not do so again. Certain others probably have never registered their bees; though they are subject to a five dollar fine for not doing so on or before October 1. Apparently the law is not enforced in most towns. In the town of Stafford, one beekeeper who failed to register on the date prescribed was prosecuted and fined. I have not heard of another similar case. The law, Chapter 174, Public Acts of 1919, as amended in Chapter 129, Public Acts of 1923, is as follows:

"Section 1. Every person owning one or more hives of bees shall, annually, on or before the first day of October, make application to the town clerk of the town in which such bees are kept, for the registration of such bees, and such town clerk shall issue to such applicant a certificate of registration upon the payment of a recording fee of twenty-five cents, which certificate shall be in the form prescribed and upon blanks furnished by the commissioner of domestic animals and shall be recorded in the office of such town clerk.

Sec. 2. A record of such registration and of the name and place of residence of the registrant and the definite location in the town where bees are kept by him shall be kept in a separate book in the office of the town clerk, which record shall be accessible to the public. Each town clerk shall file with the state entomologist of the Connecticut Agricultural Experiment Station a complete list of such registrations and locations on or before the first day of February of the year succeeding such registrations. Any town clerk failing to perform such duty shall be fined not more than ten dollars."

Sec. 3. Any owner of bees who shall fail to register as required by the provisions of this act shall be fined not more than five dollars."

According to records in this office, 1,416 beekeepers registered in the State in 1923, yet the inspections of 1924 contained 166 names that were not registered the preceding October. As only 923 apiaries were inspected in 1924, which is less than two-thirds of the number registered, there must have been considerably more than 166 beekeepers who failed to register. Moreover, it is rather difficult to obtain complete data from the town clerks.

Of course the law does not compel them to report to the State Entomologist in case no bees have been registered in a given town. Yet unless they do report, the State Entomologist has no way of knowing whether none were registered or whether registrations were made and the clerk failed to report them. Repeated requests and considerable correspondence have been necessary to obtain from the town clerks even an approximate record of the beekeepers who have registered throughout the State.

All beekeepers should each year on or before October 1, register with the town clerk in the towns where their bees are kept.

All town clerks should report complete data regarding such registration to the State Entomologist. They need not wait to do this but may report any time after October 1, and must do so on or before February 1, following such registration.

REPORT OF GIPSY MOTH WORK.

Year Ending June 30, 1924.

By W. E. Britton and John T. Ashworth.

This work has been conducted as in former years by State and Federal agencies working in co-operation, the Federal agencies expending their efforts near the margin of the area known to be infested in order to prevent further spread and the State forces working within the infested area in order to hold the pest in check. This co-operation has proven very satisfactory and we hereby wish to express our appreciation and thanks to Mr. A. F. Burgess, in charge of moth work and Mr. H. L. Blaisdell, in charge of field work, both of the Federal Bureau of Entomology.

A somewhat detailed account of how the work is organized and prosecuted was published in the 22nd Report of the State Entomologist, page 290 (see Report of Connecticut Agricultural Experiment Station for 1922, page 290) and need not be repeated here. The fact that a larger area is now infested than was known to be infested at that time does not mean that the pest has been spreading rapidly during this period. The explanation lies rather in the extensive windspread of May, 1920, and possible additional spread of 1921, the limits of which have only recently been discovered. Both Federal and State funds have not been adequate to cover all suspected territory in any one season.

New Equipment.

The Buick touring car purchased in 1921 was exchanged March 31, 1924, for a new Buick of similar type.

One new Ford light delivery truck was purchased on December 24, 1923.

As some of the spray hose had seen its best days, it was necessary to replace it, and five hundred feet were purchased on June 23, 1924, from the Acme Rubber Company of Boston, Mass.

The above-mentioned articles, together with a few small tools such as pliers, screw drivers and hammers, comprise the new equipment for the year.

Details of Infestations.

WINDHAM COUNTY.

As Windham County lies nearest to the center of the large infested region in New England and was the first county in the State to become generally infested with the gipsy moth, it may rightly be regarded as the most densely infested portion of Connecticut. Such is the case. The following table will show the conditions in the county in 1923 as compared with those in 1917, but does not include the towns of Thompson, Woodstock, Putnam and Plainfield, where the scouting was not completed this year.

Year	Colonies Found	No. of Egg-Clusters	Colonies Sprayed
1917.....	245	3,758	45
1923.....	150	3,089	114

By comparing these figures, it will be seen that the control measures taken and the work done have not been in vain. Parasites have been liberated over the entire county and it is our aim to collect egg-masses in this district this season to determine whether or not they have become established and to what extent they are working.

The following is a brief summary of the work done in each town in the county. In Brooklyn, though no large colonies were found, one of 34 egg-clusters in woodland owned by John Harrington a little west of the Old Trinity Church, and another of 23 egg-clusters in oaks in the Quinebaug mill yard, were the two largest colonies found in the town. Fifteen of the 16 colonies were sprayed by State men in the summer.

Canterbury was scouted in the early fall, and the infestations found were all in the northern half of the town. Three small colonies were found just south of Westminster village, and all others were north of this region. The largest was one of 83 egg-clusters in mixed woodland and a stone wall on land owned by Sherman Gallowy in the northwestern part of the town, near the Hampton line. Ten of the 13 infestations were sprayed by State men in June.

One of the five colonies found in Chaplin contained 24 egg-clusters, but the others were all small. Seven single egg-clusters were also found scattered widely over the town. The above-mentioned infestation was found in two white oaks on a woodland edge owned by John Evans in the extreme northwestern corner

of the town near the Ashford line. All five of the colonies were sprayed by State men during June.

Hampton was scouted the latter part of August, four colonies and five singles being found. The colonies were all small, the largest containing 17 egg-clusters on apple trees and in a stone wall on an abandoned farm in the northern end of the town about one quarter mile from the Ashford town line. Three of the colonies were sprayed in June by State men.

Killingly was used as a school for training new men this year. The result shows the town to be infested generally, and that there are several large colonies. Four of the largest will be described in this report. The largest one had 490 egg-clusters on willow, maple and apple trees located on Mechanics Street, Danielson. The willow trees were badly infested, and most of the egg-clusters were found on them. Another colony of 96 egg-clusters was found in woodland owned by Mrs. Simmons and Mrs. Clement located nearly on the Rhode Island State line in the southeastern part of the town. One of 73 egg-masses was found in woodland owned by E. T. Kelley near the Plainfield town line on the east side of Snake meadow brook. The fourth one contained 46 egg-masses on apple and oak trees along the edge of woodland owned by T. E. Hopkins near the Hygeia water reservoir. There were a number of other colonies containing from 15 to 25 egg-clusters each. During the summer, 63 of the 88 infestations in the town were sprayed by State men.

Plainfield was only partly scouted this year, about 20 miles of road in the southern part of the town being done. One colony of 16 egg-clusters and seven single egg-cluster infestations were found. The colony was on a white oak on the roadside at Joe Bole's place, located in the south center of the town near the Griswold town line. This place was sprayed in the summer by State men.

As in the case of Plainfield, Putnam was only about one-fourth scouted, the work being done in the eastern end of the town, where five colonies and four single egg-clusters form the total. None of the colonies were large, 16 egg-clusters in an apple orchard at Cady's corner being the largest. Three of the colonies were sprayed in the summer by State men.

In Scotland, the work was confined to the territory around last year's infestations on account of the lateness in the season when this town was reached. Two small colonies of seven egg-clusters each were found in the center of the town near the post office, one on land owned by Charles Wheeler and the other on land owned by Louis B. Crosby. One single egg-mass was found in an apple tree owned by Mr. Romson located in the extreme northwestern corner of the town. Both of the seven egg-cluster colonies were sprayed in June by State men.

Twenty colonies were discovered in Sterling this year, only two

of them being very large. One of 85 egg-clusters was found in an orchard owned by Mr. Brown, about one and a half miles north of Oneco village. The other contained 56 egg-clusters in an oak owned by E. Wicks, about two and a half miles north of the above-mentioned colony. Fifteen of these colonies were sprayed in June by State men.

About 26 miles of roadside scouting were done in the town of Thompson by men who were being trained. This took in nearly the whole northeastern quarter of the town. Eighteen colonies were found, all small except two; one of 128 egg-clusters in an apple orchard and stone wall on land owned by Allen Bixby along the State road connecting Brandy Hill and Webster, Mass., near the Midland division railroad crossing; the other was in woodland at the northern end of Quadick Reservoir owned by Sheriff Bates, where 60 egg-clusters were found. Fifteen of the 18 places were sprayed during the last of June and first of July by State men.

Windham was one of the last towns to be scouted this year, and the spraying season came on before the work was completed. Thirty-five miles of roadway were covered and only one colony of six egg-clusters could be found. This was in an oak tree in a pasture owned by William F. Spokesfield in South Windham.

The scouting done in Woodstock was started in the late spring and the men kept at it until the spraying crew overtook them. Spraying was stopped on July 12, for by that time the larvae were nearly mature, and eating very little. Spraying under such conditions does very little good. Seventy infestations were found in the northern half of the town that was covered; single egg-clusters where larvae were found feeding were sprayed the same as colonies of five or more egg-clusters each. No very large colonies were found, four of the largest being as follows: one of 67 egg-clusters in a roadside oak owned by Edward Chamberlin near the north end of Roseland Lake; another of 50 egg-clusters in an orchard and woodland owned by L. M. Dodge in the northwestern corner of the town near the Massachusetts line; two others, one of 44 and one of 43 egg-clusters on land owned by Mr. Redhead and I. A. Paine respectively, located about two miles west of the North Woodstock post office, both in apple orchards. Sixty-five places were sprayed by State men in Woodstock this spring.

TOLLAND COUNTY.

Coventry was scouted by State men this year. The three largest colonies were found in a straight line east and west along the northern end of the town nearly parallel with the Tolland line. The other four infestations were small and widely scattered. One of the above mentioned colonies was in apple and oak trees in a pasture owned by Phineas Talcott, and contained 13 egg-clusters. Another of 17 egg-clusters was found in an old apple tree

on land owned by S. R. Carpenter, and the third had 11 egg-clusters in an orchard owned by W. R. Hawkins. Spraying was done at two of these places on June 17 by State men.

The scouting done in Ellington was in the sections of the town where infestation occurred last year, and all but two of the infestations were found on or near the Vernon and Somers State road. These were all small, one of 14 egg-clusters in Mr. Kobbe's orchard near the Somers line being the largest, and another of nine egg-clusters in an orchard and wall owned by Frank Gotcha about two miles east of the colony just described. On June 13, five of the colonies in Ellington were sprayed by State men.

Several large colonies were discovered in Mansfield this year. The town is generally but lightly infested. Three of the largest colonies may be described as follows: one of 68 egg-clusters was found in shade trees in the dooryard of W. H. Dumack in the extreme southwestern corner of the town; another of 60 egg-clusters in an orchard owned by Mr. Early in Mansfield Center; the last was a colony of 53 egg-clusters in apple and plum trees owned by Bark Shelchofer in the Merrow district. Thirteen colonies were sprayed in June by State men.

The three infestations found in Somers this year were discovered by a Federal man while making collections and observing the date of the first hatching of larvae in this section of New England. They were cleaned up and creosoted by State men, and also two of the places sprayed on June 12. None were large colonies, the largest being one of 18 egg-clusters in two apple trees in a pasture owned by Mr. Miller. Another of six egg-clusters was in two apple trees in a pasture owned by F. Kibbe in the village of Somers. A third infestation of two egg-clusters was found in an orchard about one and a half miles north of the two colonies just mentioned and owned by H. N. Kibbe.

On account of the lateness in the season when scouting was taken up in Tolland, the work was confined to the territory around last year's infestations. Scouting was done in an area about one mile outside each place where the gipsy moth was found last year, but nothing was found at any of these places.

Similar work was done in Vernon, and no egg-clusters were found in the town.

In Willington, nearly all the infestations were found in the northern half of the town, the largest one being in an orchard owned by Frederick Draper, about a mile east of West Willington post office, containing 33 egg-clusters. Another of 32 egg-clusters was found in an orchard owned by Felix Kash on the State road leading to Stafford Springs, about one mile south of the Stafford line. Twenty-five egg-clusters were found in an orchard owned by Emery Kucko in the north center of the town. The other colonies were nearly all under five egg-clusters each, and 11 places were sprayed in June by State men.

HARTFORD COUNTY.

The scouting in Hartford County was all done by State men this year and every town in the county was fully scouted except Marlborough. In Bristol, Canton, Glastonbury, Manchester, Newington, Plainville, West Hartford and Windsor Locks no gipsy moth infestations were found.

In Avon, one colony of 12 old egg-clusters was found on oaks in woodland owned by Edward Lasing, near the center of the township. In the spring after hatching had started, men were sent to look for larvae or signs of feeding there, but as none were found, no further work was thought necessary.

One colony of four egg-clusters was found in Berlin on a roadside maple on the property of Ralph R. Carter, near the Hartford State road just south of Berlin village. On June 18, this colony was sprayed by Federal men.

Four of the six infestations found in Bloomfield were situated within one mile of the post office and the other two were in the northwestern part of the town. The largest colony contained 40 egg-clusters on willow and oak trees owned by William Sherman at the first four corners west of the post office. The next largest colony was on apple trees owned by Miss Isabelle Tollar in the northwestern part of the town, where 13 egg-clusters were found. The other infestations were small. All six places were sprayed on June 19 by Federal men.

In Burlington, two colonies were found this year, one of 14 egg-clusters in an orchard owned by Mr. K. Szuster in the northwestern part of the town, and another of nine egg-clusters also in an orchard, in the southwestern corner of the town and owned by Mr. Christian Dichal. The first colony mentioned was sprayed June 21 and the other June 25 by Federal men.

Three infestations were found in East Granby this season. Two of them were large ones for this territory, although not hard to reach and control. The first was one of 70 egg-clusters found on willow trees and fence posts owned by Mr. Vitten about one-half mile north of the post office. The next largest was one of 63 egg-clusters on trees in a yard owned by E. W. Kellogg in the extreme northwestern part of the town. One small colony of two egg-clusters was found in an orchard owned by J. R. Holcomb. All three of the infestations were sprayed by Federal men on June 25.

East Hartford was scouted during the last of March and the first of April. One colony was found along the Connecticut River bank just north of the bridge on land owned by the Hartford Bridge Commission, where 31 egg-clusters were found on four willow trees. Two other small infestations were found in the town. Two places were sprayed on June 11 by State men.

Four small infestations were found in East Windsor, the largest colony containing seven egg-clusters, in an orchard owned by

Mrs. A. E. Haynes in the eastern part of the town. The other three infestations contained one, two and three egg-clusters respectively. Three of these infestations were sprayed on June 11 by State men.

In Enfield, one colony of 10 egg-clusters and three smaller ones were found. They were widely separated, there being one on each side of the town. The colony mentioned above was found in oaks on land owned by Andrew Gornet in the southeastern corner of the town. All four of the places were sprayed June 12 by State men.

In Farmington, two colonies and one single egg-cluster were found this year. Thirty-five egg-clusters were found in apple trees on land owned by John Wall about one mile west of the village. The other colony was in woodland owned by Charles Beech in the extreme northeastern corner of the town, where there were 28 egg-clusters on 10 different trees. Both these colonies were sprayed in the spring by Federal men. Twelve acres of woodland were sprayed at the woodland colony.

Five infestations were found in Granby this year, containing a total of 159 egg-clusters. Of this number, 145 egg-clusters were found in woodland owned by Max Shinder in the southwestern corner of the town near the Canton line. The Federal men sprayed three of the infestations on June 23.

Six colonies were found in Hartford this season. Five of them had over 15 egg-clusters each, and one in particular was a very large colony. This infestation was situated near the river east of the Fuller Brush Company's factory on Windsor Avenue. Nine hundred and thirty-six egg-clusters were found on willow, oak and maple trees here. This colony was one of the hardest to control of any found in the entire State this year, as the land was under water nearly all this spring. Spraying was done, however, by Federal men about the middle of June, 625 pounds of dry lead arsenate being used in the operation. A colony of 25 egg-clusters was found on Farmington Avenue; one of 15 egg-clusters on West Boulevard on apple and maple trees owned by Mr. Kenneth French; a colony of 27 egg-clusters on apple, elm and willow trees near the brook west of Hillside Avenue; one of 22 egg-clusters on apple trees and rose bush in yard owned by A. O. Doule on Allen Place; and the last was a colony of 24 egg-clusters found on New Britain Avenue at the Kings Daughters House, on apple and poplar trees, and on the foundation and sides of the house. All the colonies were sprayed by Federal men in June.

Hartland had five infestations found in it this year, with a total of 29 egg-clusters; 15 were in an orchard owned by the T. A. Howell Estate in the northwestern part of the town; the other infestations were small. Four of the colonies were sprayed by Federal men in July.

In New Britain three single egg-cluster infestations and one colony of 110 egg-clusters were found in oak trees, on houses, hen coops and fences on Bassett Street opposite the High School. This colony was sprayed June 21 by Federal men.

One large colony containing 137 egg-clusters was found in Rocky Hill on a pasture oak owned by Thomas Griswold, in the center of the township. This colony was sprayed by Federal men on June 11.

A small woodland colony of five egg-clusters was found in Southington on land owned by Charles Stewart in the southeastern corner of the town near the Meriden town line.

The two colonies found in South Windsor were both in the northwestern part of the town; one of 18 egg-clusters was in two apple trees in a field owned by Paul Banker and the other was in an orchard owned by H. F. Farnham. Both of these places were sprayed on June 11 by State men.

The town of Suffield was found to have 17 infestations scattered over the entire township. Some were quite large; one colony in particular in willow trees on land owned by Miss Antoinette Clark about one mile north of the village, near the State road leading to Enfield contained 650 egg-clusters. There were two other large colonies, one in an orchard owned by William Carney of Hasting Hill, containing 50 egg-clusters, and the other in four willow trees on Holiday Avenue, owned by Walenta Drenscak, containing 45 egg-clusters. The other infestations were small. Sixteen of the 17 infestations were sprayed in June by Federal men.

In Simsbury two infestations were found, one along both sides of the State road just south of the village, on land owned by The Ensign-Bickford Company, containing 458 egg-clusters, on oak, apple and elm trees. The other was a small colony of three egg-clusters in an orchard owned by Anson P. Tyler in the western end of the town near the Canton town line. Both colonies were sprayed by Federal men. At the larger colony, 1,125 pounds of dry lead arsenate (making 18,000 gallons of spray mixture) were used.

In Wethersfield, four infestations containing 626 egg-clusters were found; 622 were on apple, maple and willow trees on both sides of the road running east from the village toward the Connecticut River, on land owned by Messrs. Rusti, Crane, T. Smith and Hale. The other three infestations were all close by and may be regarded as a natural spread from the large colony. Three of the places were sprayed in June by Federal men.

Three of the five infestations found in Windsor this year were close together in the southern end of the town near the Hartford line. The largest was one of 73 egg-clusters on willow and walnut trees in a field owned by J. M. Sloan; another just north of this colony had 16 egg-clusters on willow trees owned by George

Reed. One colony of 17 egg-clusters was found in an oak tree owned by William Kennedy in the northwestern part of the town. Four of the colonies were sprayed by Federal men on June 20.

LITCHFIELD COUNTY.

A large portion of the territory in Litchfield County was covered by the Federal men, including the following towns where no infestations were found: Bethlehem, Bridgewater, Canaan, Kent, North Canaan, Roxbury, Sharon, Warren, Watertown, Washington and Woodbury. Harwinton was scouted by State men and nothing found. The following is a description of the infestations in Litchfield County.

Barkhamsted was scouted by State men and three infestations discovered. All were small ones and in apple orchards. One colony was sprayed June 9 by Federal men.

State men scouted Colebrook and five infestations were found, three of which are herein described. The largest was one of 16 egg-clusters on apple and maple trees owned by L. J. Phelps near the Norfolk line. Another of 11 egg-clusters was in an apple orchard just east of Colebrook post office owned by W. E. Lewis. The third colony was a peculiar one, containing 10 male and 25 female pupae in cavities in old apple trees owned by G. C. McKenzie about half way between the two colonies mentioned above. The moths had all emerged but not a single egg-cluster could be found. Four of the infestations were sprayed in June by Federal men.

Cornwall was scouted by Federal men, one colony of 46 egg-clusters being found in the southern part of the town about one mile west of East Cornwall village, in woodland owned by W. C. Clark. Over 14 acres of woodland was sprayed here by Federal men in the summer.

One four egg-cluster colony was found in New Hartford by State men in an apple tree owned by Koch Brothers, about two miles west of the New Hartford post office. It was sprayed on July 9 by Federal men.

All work in New Milford was done by Federal men. One colony of 35 egg-clusters was found in woodland owned by F. L. Wanger and H. T. Erickson in the southern end of the town near the New Fairfield line. About 26 acres of woodland were sprayed.

The scouting in Plymouth was done by State men and confined to the territory around last year's infestation, but nothing was found.

Two infestations were found in Salisbury, both of them on property owned by Thomas Bornetti, about a mile north of the Salisbury post office. Eight egg-clusters were found at both places, and about four acres of woodland sprayed, all the work being done by Federal forces.

Torrington and Winchester were both scouted by State men. One old egg-cluster was found in each town. No further work was thought necessary.

NEW LONDON COUNTY.

East Lyme was scouted by State men this year the latter part of April and the first of May. One colony of 10 egg-clusters was found in woodland oaks owned by Mr. Dennison located on the road leading to Black point. This colony and woodland around it to the extent of one acre were sprayed in the summer by State men.

About 84 miles of roadside scouting was done in Griswold this spring by a State crew, the largest colony found being one of seven egg-clusters in woodland owned by William Sullivan in the northeastern corner of the town near the Plainfield town line. Another of five egg-clusters was found in white oaks in the village of Glasko. The five other infestations were all smaller. Four of the seven places were sprayed by State men about the middle of June.

There were three clusters of infestations found in Groton this year, one in each of the villages of Groton, Noank and Mystic river; in the remainder of the township only five scattered colonies were found. The infestations were all small, 15 egg-clusters being the largest; these were in apple trees owned by Charles Heath and Charles Benjamin, located on the State road just west of Mystic River village. The next largest was in Noank on maple and apple trees owned by H. E. Bently, where 13 egg-clusters were found; the other infestations were nearly all under five egg-clusters each. Spraying was done at 12 of the 19 infestations this summer by State men.

In Lisbon three of the four infestations found were in the southern part of the town near the Quinebaug River, and the fourth was a single egg-mass in an orchard in the northern part of the town. There were two colonies large enough to mention; one of 21 egg-clusters found in apple and oak trees on land owned by Sherman Waters, and the other contained nine egg-clusters in an orchard belonging to Paul Geist. Both colonies were along the river; three of the infestations were sprayed on June 14 by State men.

One colony of 14 egg-masses was found in an old apple tree in Mr. John Barko's pasture in Montville this season. This tree was cut down and split open and the egg-clusters creosoted. No further work was thought necessary at this colony.

In New London two infestations were found, one of four egg-clusters on apple trees in the yard of Mr. E. N. Crocker, and the other of three egg-clusters on maple shade trees on town property. Both of these infestations were sprayed June 10 by State men.

Five infestations were found in Norwich, with a total of 31 egg-clusters. Over half of them were found at one place, in an

apple tree and stone wall in a pasture owned by Louis Webber in the district known as East Great Plain, containing 17 egg-clusters. The other four colonies were all small, five egg-clusters being the largest. Three of the five infestations were sprayed June 13 by State men.

The scouting in Old Lyme was confined to the sections of the town where gipsy moth infestations were found last year, namely, the northeastern and southwestern parts of the township. About 50 miles of roadside scouting was completed and nothing found.

One hundred and ninety-five egg-clusters were found in Preston, of which 144 were in two colonies. The first to be mentioned was the largest and was found in a white oak and stone wall in a pasture owned by Mr. Boswell, just west of Preston village on the south side of Prospect Hill, containing 122 egg-clusters. The next largest was one of 22 egg-masses, found on oak and apple trees in H. L. Harris' yard in the west end of the town near Laurel Hill; the four other colonies were small. All but one of these colonies were sprayed in June by State men; this one could not be reached with the hose available.

On account of the lateness of the season when reached, the scouting in Voluntown had to be confined to the areas around last year's infestations as larvae were already hatching. Three infestations were found, none of them large. Two of the colonies were close together in the southwestern corner of the town near the Griswold line; one contained seven and the other three egg-clusters. It was impossible to spray at these places as the road was impassable for the sprayer truck. The single egg-mass infestation found on an apple tree owned by Mr. Wilcox near the pond in Great Meadow Brook was sprayed as larvae were found feeding when the egg-cluster was discovered. This work was done by State men.

One egg-cluster was found in Waterford and the larvae had already hatched and were feeding. This egg-mass was in an apple orchard owned by G. W. Peabody, located about one mile north of Manetock Hill near Jordan Brook. This infestation was sprayed June 11 by State men.

MIDDLESEX COUNTY.

Only one town, Cromwell, in Middlesex County was completely scouted this year, though two other towns were partly scouted, all the work being done by State men.

In Cromwell, no egg-clusters were found.

Old Saybrook was scouted only around last year's infestations and nothing was found.

In Middletown, similar methods were used and one new egg-cluster found on an apple tree in an orchard owned by C. L. Johnson near Bear Hill. This egg-cluster was found just outside last last year's infestation at Mr. Johnson's place. Spraying was considered unnecessary.

NEW HAVEN COUNTY.

Two towns in New Haven County, Hamden and New Haven, were found to be infested this year, one colony being found in each town. That in New Haven was at 387 Howard Avenue, just south of the railroad bridge in three trees and on shrubs in a yard owned by M. J. Paxson, and contained six egg-clusters. The spraying was done on May 31 by State and Federal men.

The infestation in Hamden contained four egg-clusters and spraying was thought unnecessary. Federal men scouted these towns, and also Bethany, Derby, East Haven, Middlebury, Milford, Orange, Oxford, Southbury and Woodbridge, in which no infestations were found.

Branford, Guilford, Madison and North Branford were scouted by State men and no infestations found. In the towns of Cheshire, Wallingford, Waterbury and Wolcott, the scouting was confined to the territory around last year's infestations because the scouting season had so far advanced by the time these towns were reached that it was impossible to complete them before the men had to begin spraying. Nothing was found in these towns.

FAIRFIELD COUNTY.

The work in Fairfield County was done by Federal men and consisted of scouting three towns, namely: Brookfield, New Fairfield and Sherman, no spraying being needed because no infestations were found.

STATISTICS OF INFESTATIONS

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae Killed
Windham County—15 Towns Infested.					
Ashford[1]	0	0	0	0	0
Brooklyn	16	219	16	302	85
Canterbury	13	253	10	222	115
Chaplin	5	62	5	75	34
Eastford	0	0	0	0	43
Hampton	4	44	3	38	18
Killingly	44	2,114	63	820	761
Plainfield[2]	1	16	1	6	6
Pomfret[1]	0	0	0	0	59
Putnam[2]	5	50	3	45	60
Scotland	3	15	2	12	2
Sterling	20	376	15	178	118
Thompson[2]	18	485	15	168	1,311
Windham[2]	1	6	0	0	130
Woodstock[2]	70	1,085	57	705	1,352
	200	4,725	190	2,571	4,094

[1] Not scouted.
[2] Partially scouted.

STATISTICS OF INFESTATIONS—*Continued*

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae Killed
New London County—20 Towns Infested.					
Bozrah[1]	0	0	0	0	0
Colchester[1]	0	0	0	0	0
East Lyme	1	10	1	44	0
Franklin[1]	0	0	0	0	0
Griswold[2]	7	21	4	63	5
Groton	19	87	12	184	54
Lebanon[1]	0	0	0	0	0
Ledyard[1]	0	0	0	0	0
Lisbon[2]	4	33	3	37	20
Lyme[1]	0	0	0	0	0
Montville	1	14	0	0	0
New London	2	7	2	37	0
Norwich	5	31	3	25	6
No. Stonington[1]	0	0	0	0	0
Old Lyme[3]	0	0	0	0	0
Preston	6	195	5	66	19
Salem[1]	0	0	0	0	0
Sprague[1]	0	0	0	0	0
Stonington[1]	0	0	0	0	0
Voluntown[2]	3	11	1	12	0
Waterford	1	1 hatched	1	6	0
	49	410.	32	474	104

[1] Not scouted.
[2] Partially scouted.
[3] Scouted only around infestations.

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae Killed
Tolland County—14 Towns Infested.					
Andover[1]	0	0	0	0	0
Bolton[1]	0	0	0	0	0
Columbia[1]	0	0	0	0	0
Coventry	7	50	2	22	0
Ellington[2]	9	39	5	63	67
Hebron[1]	0	0	0	0	0
Mansfield	31	405	13	131	169
Somers[2]	3	26	2	13	5
Stafford[1]	0	0	0	0	0
Tolland[3]	0	0	0	0	0
Union[1]	0	0	0	0	0
Vernon[3]	0	0	0	0	0
Willington	22	215	11	101	77
	72	735	33	330	318

[1] Not scouted.
[2] Partially scouted.
[3] Scouted only around infestations.

STATISTICS OF INFESTATIONS—*Continued*

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae Killed
Middlesex County—3 Towns Infested.					
Chester[1]	0	0	0	0	0
Clinton[1]	0	0	0	0	0
Cromwell	0	0	0	0	0
Durham[1]	0	0	0	0	0
East Hampton[1]	0	0	0	0	0
East Haddam[1]	0	0	0	0	0
Essex[1]	0	0	0	0	0
Haddam[1]	0	0	0	0	0
Killingworth[1]	0	0	0	0	0
Middletown[3]	1	1	0	0	0
Old Saybrook[3]	0	0	0	0	0
Portland[1]	0	0	0	0	0
Saybrook[1]	0	0	0	0	0
Westbrook[1]	0	0	0	0	0
	1	1	0	0	0

[1] Not scouted.
[2] Partially scouted.
[3] Scouted only around infestations.

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae Killed
Hartford County—29 Towns Infested.					
Avon	1	12*	0	0	0
Berlin[2]	1	4	1	4	0
Bloomfield	6	67	6	150	1
Bristol	0	0	0	0	0
Burlington	2	23	2	68	1
Canton	0	0	0	0	0
East Granby	3	135	3	225	10
East Hartford	3	35	2	19	1
East Windsor	4	13	3	31	5
Enfield	4	15	4	37	4
Farmington	3	64	2	581	0
Glastonbury	0	0	0	0	0
Granby	5	159	3	75	11
Hartford	6	1,043	6	587	1,178
Hartland	5	29	4	285	5
Manchester	0	0	0	0	0
Marlborough[1]	0	0	0	0	0
Newington	0	0	0	0	0
New Britain	4	113	1	344	20
Plainville	0	0	0	0	0
Rocky Hill	1	137	1	88	21
Southington	1	5	0	0	0
South Windsor	2	24	2	10	4
Suffield	17	913	16	612	183
Simsbury	2	461	2	1,175	301
Wethersfield	4	626	3	75	0
West Hartford	0	0	0	0	0
Windsor	5	110	4	162	3
Windsor Locks	0	0	0	0	0
	79	3,988	65	4,528	1,748

[1] Not scouted.
[2] Partially scouted.
*Old egg-clusters.

STATISTICS OF INFESTATIONS—*Continued*

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae Killed
Litchfield County—13 Towns Infested.					
Bethlehem[4]	0	0	0	0	0
Bridgewater[4]	0	0	0	0	0
Barkhamsted	3	9	1	30	50
Canaan[4]	0	0	0	0	0
Colebrook	5	34	4	475	1
Cornwall[4]	1	46	0	0	0
Goshen[1]	0	0	0	0	0
Harwinton	0	0	0	0	0
Kent	0	0	0	0	0
Litchfield[1]	0	0	0	0	0
Morris[1]	0	0	0	0	0
New Hartford	1	4	1	60	0
New Milford[4]	1	35	0	0	0
Norfolk[1]	0	0	0	0	0
North Canaan	0	0	0	0	0
Plymouth[3]	0	0	0	0	0
Roxbury[4]	0	0	0	0	0
Salisbury[4]	2	8	0	0	0
Sharon[4]	0	0	0	0	0
Thomaston[1]	0	0	0	0	0
Torrington[4]	1	1*	0	0	0
Warren[4]	0	0	0	0	0
Watertown[4]	0	0	0	0	0
Washington[4]	0	0	0	0	0
Winchester	1	1*	0	0	0
Woodbury[4]	0	0	0	0	0
	15	138	6	565	51

[1] Not scouted.
[2] Partially scouted.
[3] Scouted only around infestations.
[4] Scouted by Federal men.
*Old egg-cluster.

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae Killed
New Haven County—6 Towns Infested.					
Ansonia[4]	0	0	0	0	0
Beacon Falls[4]	0	0	0	0	0
Bethany[4]	0	0	0	0	0
Branford	0	0	0	0	0
Cheshire[3]	0	0	0	0	0
Derby[4]	0	0	0	0	0
East Haven[4]	0	0	0	0	0
Guilford	0	0	0	0	0
Hamden[4]	1	4	0	0	0
Madison	0	0	0	0	0
Meriden[1]	0	0	0	0	0
Middlebury[4]	0	0	0	0	0
Milford[4]	0	0	0	0	0
New Haven[4]	1	6	1	15	0
North Branford	0	0	0	0	0

STATISTICS OF INFESTATIONS—*Concluded*

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae Killed
New Haven County—*Concluded.*					
North Haven[1]	0	0	0	0	0
Orange[4]	0	0	0	0	0
Oxford[4]	0	0	0	0	0
Seymour[4]	0	0	0	0	0
Southbury[4]	0	0	0	0	0
Wallingford[3]	0	0	0	0	0
Waterbury[3]	0	0	0	0	0
Wolcott[3]	0	0	0	0	0
Woodbridge[4]	0	0	0	0	0
	2	10	1	15	0

[1] Not scouted.
[2] Partially scouted.
[3] Scouted only around infestations.
[4] Scouted by Federal Men.

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae Killed
Fairfield County—No Towns Infested.					
Brookfield[4]	0	0	0	0	0
New Fairfield[4]	0	0	0	0	0
Sherman[4]	0	0	0	0	0
	0	0	0	0	0

[4] Scouted by Federal men.

SUMMARY OF STATISTICS

County	No. Towns Covered	No. Infestations	No. Egg-Clusters Destroyed	No. Infestations Sprayed	No. Lbs. Arsenate Used	No. Larvae Destroyed	No. Miles Roadway Scouted
Windham	13	200	4,725	190	2,571	4,094	659
New London	11	49	410	32	474	104	751
Tolland	7	72	735	33	330	318	391
Middlesex	3	1	1	0	0	0	50
Hartford	28	79	3,988	65	4,528	1,748	2,083
Litchfield	21	15	138	6	565	51	1,529
New Haven	22	2	10	1	15	0	1,337
Fairfield	3	0	0	0	0	0	175
	108	418	10,007	327	8,483	6,315	6,975

Thus it will be seen from the preceding table that work was done in 108 towns last year; that 418 gipsy moth infestations were found and 327 of them sprayed with lead arsenate, using 8,483 pounds or nearly four and one-fourth tons; that 10,007 egg-clusters were destroyed with creosote, and 6,315 larvae destroyed, besides those which may have been killed by the spray; also that 6,975 miles of roadway were scouted by the State men in this

work. In the towns scouted by the Federal men, no record was kept of the number of miles of roadway covered.

Financial Statement.

RECEIPTS

Appropriation for biennial period ending June 30, 1925	$100,000.00

Classified Expenditures for the Period Ending June 30, 1924

Salaries and Wages		$33,749.13	
Printing and Illustrations		48.33	
Postage		12.14	
Stationery		9.56	
Telegraph and Telephone		27.51	
Insurance (supplies including horse sprayer)		29.97	
Spraying Supplies		337.50	
Machinery, Tools and Supplies		345.04	
Express, Freight and Cartage		2.43	
Rental and Storage		761.57	
Automobiles: New	$1,384.00		
Insurance	467.45		
Repairs	874.15		
Supplies and Equipment	1,019.14		
Gasoline	1,610.81		
Oil	161.29		
		5,516.84	
Traveling Expenses		363.42	
Inspection of Imported Nursery Stock		498.09	
Heat and Light		96.48	
			$41,798.01
Balance			58,201.99
			$100,000.00

Parasites.

A somewhat detailed account of the different parasites and predatory insects which have been introduced into this country to attack the gipsy moth may be found in the 22nd Report of the State Entomologist, page 313 (Report of this Station for 1922, page 313) and need not here be repeated. In last year's report, page 265, a table shows the number of individuals of the Japanese egg parasite, *Schedius kuvanae* How., which were liberated in Connecticut in 1923. In 1924, there were liberated in Connecticut, 733,650 *Schedius kuvanae,* 243,000 of another egg parasite, *Anastatus bifasciatus* Fonsc., by State men, and 3,000 of a larval parasite, *Apanteles melanoscelus* Ratz., by Federal men. All of these parasites were reared at the Government parasite laboratory in Melrose Highlands, Mass., and furnished by Mr. Burgess for distribution in Connecticut. The following list, also furnished by Mr. Burgess, shows the number of each kind of parasite liberated, as well as the towns where they were planted:

GIPSY MOTH PARASITES LIBERATED IN CONNECTICUT
Year Ending June 30, 1924

	Schedius kuvanae	*Apanteles melanoscelus*	*Anastatus bifasciatus*
Brooklyn	56,000		
Canterbury	24,000		
Chaplin	24,000		
Colchester	4,000	500	
Columbia			11,000
Coventry			16,000
Eastford	96,000		
East Lyme	17,900		
East Windsor			11,000
Ellington			23,000
Enfield			4,000
Griswold	40,000		
Groton	20,000		7,000
Hampton	40,000		
Hartford			7,000
Lebanon	9,850	500	3,000
Ledyard	12,000	500	11,000
Lisbon	20,000		
Mansfield			23,000
Montville		500	1,000
New London	28,000		5,000
No. Stonington	4,000		24,000
Norwich	24,000		5,000
Old Lyme	12,000		
Plainfield	20,000		
Pomfret	60,000		
Preston	12,000		15,000
Rocky Hill			2,000
Scotland	32,000		
Simsbury			3,000
Somers	20,000		
South Windsor		500	7,000
Sprague	12,050		
Stafford	24,000		1,000
Sterling	17,850		
Stonington	28,000		
Suffield			17,000
Tolland			25,000
Vernon		500	
Voluntown	32,000		
Waterford	12,000		3,000
Wethersfield			4,000
Willington			15,000
Windham	32,000		
	733,650	3,000	243,000

Unquestionably much benefit has resulted from the combined attacks of the various parasites in the New England area, though the reduction in the numbers of the gipsy moth should not be attributed wholly to the action of parasites. It is the opinion of all men engaged in gipsy moth work, that creosoting of egg-clusters, spraying around infestations, and low temperature which

kills the eggs, are in some measure responsible for the decrease and together with the parasites, have brought about the present conditions. We hope that these gratifying conditions may continue but this is uncertain. It is probably true that there was less stripping in Massachusetts in 1924 than for many years, and as shown in the table on page 255, there were fewer colonies found in Windham County (the County longest continuously infested) than in 1917. These results must in part be accredited to the work of parasites, but it is still too early to abandon the field to them and appropriations should be continued for several years until they surely and permanently gain control of the gipsy moth.

Barrier Zone.

The plan of establishing a barrier or control zone, beyond which the gipsy moth will not be allowed to gain a foothold, was first advocated at a conference held in Albany, November 16, 1922. The proceedings of this conference were published as Agricultural Bulletin 148, Department of Farms and Markets of the State of New York, Albany, December, 1922, and the resolutions were included in the Report of this Station for 1922, page 325. Such a zone would be of no value unless extremely careful and thorough work is maintained in it, and this work is obviously the province of the Federal forces aided by those States west of the zone. However, the success of the plan depends principally upon appropriations adequate to carry it out. Nevertheless, to some extent its success will depend upon the degree of infestation near and east of the barrier zone, and here is where the New England States can help; for if the degree of infestation in western New England is slight, it will be much easier to maintain such a zone. If this area were intensely infested, and the condition favorable for windspread westward, infestations would certainly be carried into and beyond this zone, and it would be difficult and expensive to eradicate them.

This proposed barrier or control zone extends from the Canadian border on the north to Long Island Sound on the south, and includes Lake Champlain and the Hudson River with a strip of land east and west of both, until the Highlands are reached, when it is deflected toward the southeast, crossing Connecticut in a line from New Milford to New Haven. This zone is approximately thirty miles in width.

Quarantines.

As the Connecticut quarantine was last revised and became effective on July 20, 1922, and many additional towns have since been found infested and placed under Federal quarantine, it seemed best to make the State quarantine coincide with the Federal quarantine. Consequently, after due hearing as provided by Section 2106 of the General Statutes, the following quarantine order was

issued as Bulletin of Immediate Information, No. 44, effective July 20, 1924:

STATE OF CONNECTICUT

AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

QUARANTINE ORDER NO. 6

Concerning Gipsy Moth

In order to protect uninfested parts of Connecticut from danger of infestation by the gipsy moth, under authority given in Section 2106 of the General Statutes, the following regulations are hereby established.

1. The following towns are hereby placed under quarantine because of the gipsy moth:—

HARTFORD COUNTY:

Avon	Farmington	Plainville
Berlin	Glastonbury	Rocky Hill
Bloomfield	Granby	Simsbury
Bristol	Hartford	Southington
Burlington	Hartland	South Windsor
Canton	Manchester	Suffield
East Granby	Marlborough	West Hartford
East Hartford	New Britain	Wethersfield
East Windsor	Newington	Windsor
Enfield		Windsor Locks

LITCHFIELD COUNTY:

Barkhamsted	Harwinton	Plymouth
Canaan	Litchfield	Salisbury
Colebrook	New Hartford	Thomaston
Cornwall	Norfolk	Torrington
Goshen	North Canaan	Winchester

MIDDLESEX COUNTY:

Chester	East Hampton	Middletown
Clinton	Essex	Old Saybrook
Cromwell	Haddam	Portland
Durham	Killingworth	Saybrook
East Haddam	Middlefield	Westbrook

NEW HAVEN COUNTY:

Branford	Madison	Wallingford
Cheshire	Meriden	Waterbury
Guilford	North Branford	Wolcott
	North Haven	

NEW LONDON COUNTY:

Bozrah	Ledyard	Old Lyme
Colchester	Lisbon	Preston
East Lyme	Lyme	Salem
Franklin	Montville	Sprague
Griswold	New London	Stonington
Groton	North Stonington	Voluntown
Lebanon	Norwich	Waterford

TOLLAND COUNTY:

Andover	Ellington	Tolland
Bolton	Hebron	Union
Columbia	Mansfield	Vernon
Coventry	Somers	Willington
	Stafford	

WINDHAM COUNTY:

Ashford	Hampton	Scotland
Brooklyn	Killingly	Sterling
Canterbury	Plainfield	Thompson
Chaplin	Pomfret	Windham
Eastford	Putnam	Woodstock

These same towns have already been quarantined by the Federal Horticultural Board of the United States Department of Agriculture, and it shall be unlawful to remove from this quarantined area any woody nursery stock, lumber, cordwood, telegraph or telephone poles, railroad ties, or other forest plant products, unless the products shall have been inspected and certified by an authorized State or Federal inspector.

2. In view of possible future changes in the lines between the infested and non-infested areas of the State, the areas quarantined by the State shall conform to those quarantined by the United States Department of Agriculture: furthermore the regulations established by the Federal Horticultural Board of the United States Department of Agriculture for inter-state shipments, are hereby adopted for the inspection and certification of similar shipments from the quarantined area to points outside of this area within the State of Connecticut.

3. This order shall take effect from its date.

Dated July 20, 1924.

W. L. SLATE, JR.
Director, Connecticut Agricultural Experiment Station.

Approved:
CHARLES A. TEMPLETON,
Governor.

The quarantined area is shown on the accompanying map, and includes the following towns not covered in quarantine order No. 4: Cornwall and Litchfield in Litchfield County; Cheshire, Wallingford, Meriden, North Haven, Branford, North Branford, Guilford and Madison in New Haven County; Middlefield, Durham, Haddam, East Haddam, Killingworth, Clinton, Westbrook, Chester, Saybrook, Essex and Old Saybrook in Middlesex County; Lyme and Old Lyme in New London County.

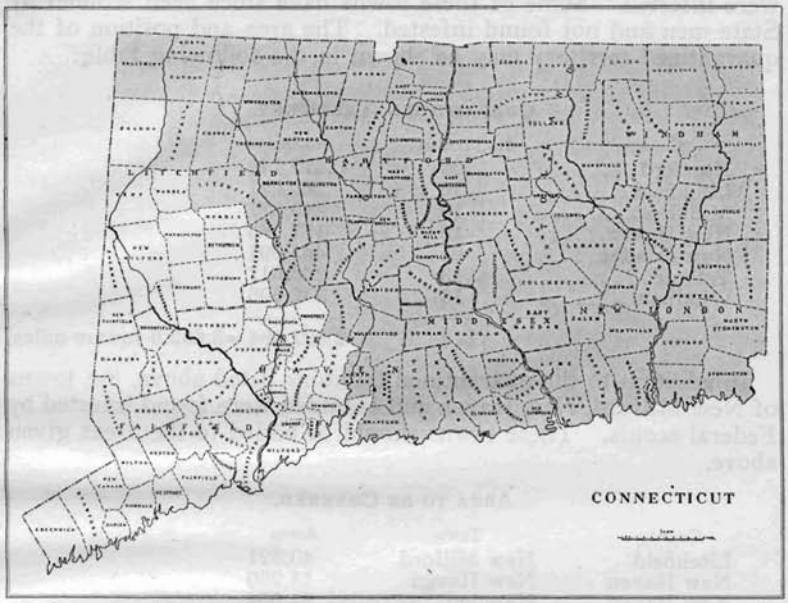

Figure 7. Map of Connecticut. The shaded portion represents the area quarantined on account of the gipsy moth.

All woody field grown nursery stock and forest products to be shipped from the quarantined area into the free area must be inspected by a State or Federal inspector and certified. All frequent shippers should procure a Federal map showing the quarantined area, the location and address of each Federal inspector and the area covered by him. These maps may be obtained from Mr. D. M. Rogers, 408 Atlantic Avenue, Boston, Mass.

An arrangement has been made by which inspections can be made by both State and Federal inspectors. Applications for inspection should be made to the nearest Federal Inspector or to:

D. M. Rogers, 408 Atlantic Ave., Boston, Mass., in charge of Federal inspection service; or

W. E. Britton, State Entomologist, Agricultural Experiment Station, New Haven, Conn., in charge of State inspection service.

Area Which Must Now Be Covered in Gipsy Moth Work.

The greatly increased area now under State and Federal Quarantine in Connecticut because of the gipsy moth includes 118 of the 169 towns of the State, though in some of these towns, especially in New Haven and Middlesex Counties near the coast, no gipsy moth infestations have ever been found. They were included in order to be on the safe side because there was not time to scout them all and it was uncertain whether or not they were infested. Some of these towns have since been scouted by State men and not found infested. The area and position of the quarantined territory may be shown in the following table:

Quarantined Territory.

County	No. Towns	No. Acres
Hartford.....	29	477,749
Litchfield.....	15	359,071
Middlesex.....	15	249,377
New Haven.....	10	187,083
New London.....	21	465,091
Tolland.....	13	266,617
Windham.....	15	332,696
	118	2,337,684 = 3,652.6 square miles.

In addition to the quarantined territory listed above, the towns of New Milford, New Haven and Hamden were found infested by Federal scouts. These towns should be added to the areas given above.

Area to be Covered.

County	Town	Acres
Litchfield	New Milford	40,321
New Haven	New Haven	14,260
New Haven	Hamden	21,054
	Three towns	75,635
Quarantined area	118 towns	2,337,684
Total	121 towns	2,413,319 = 3,770.8 square miles.

Recommendations.

Considering the large increase in territory to be covered; that there has never been a sufficiently large appropriation to cover the infested territory in one season, and that it will now be difficult to get over it all in two seasons; that it is uncertain just how much can be done by the Federal forces in Connecticut: we have asked for an appropriation of $140,000.00 for the next two years. This is an increase of $40,000.00 over the last appropriation, and seems necessary if the work is to be done properly over the larger territory. The amount requested ($140,000.00) is equivalent to $37.13 per square mile, or five and eight-tenths cents (.058) per acre of ground which must be covered.

THE EUROPEAN CORN BORER IN CONNECTICUT.

W. E. Britton and M. P. Zappe.

In the Report of this Station for 1923, page 277, is an account of three small infestations of the European corn borer, *Pyrausta nubilalis* Hubn., discovered along the Connecticut shore, and measures taken to eradicate them. During 1924, further work was done by Station men in co-operation with the Bureau of Entomology, U. S. Department of Agriculture. Federal scouts began early in the season and examined the entire coast region of the State from New York to Rhode Island, and extending inland for at least one mile. Then scouting was done around the principal seed corn growing districts in Milford, Orange and Wethersfield. Messrs. Zappe and Rogers of this office did supplementary scouting in Woodbridge, Wethersfield, Rocky Hill, Middletown and Salem, equivalent to 14 man days.

As a result of this scouting work, seven small infestations were found by the Federal men in the following locations: one in a corn field at Hillside Home, Bridgeport, in the northeastern portion of the city; one in gardens in New Haven, near the corner of Forbes and Townsend Avenues; one in a small corn field owned by Mr. Way on the eastern side of the town of Old Lyme; one in corn in East Lyme on land of Mr. E. W. Russell; one in corn in Groton on land of Mr. Frank Burnham, about three-fourths of a mile north of the town hall; and two in corn in Stonington, both in gardens near each other in the easterly portion of Mystic, one owned by Mr. Henry W. Morgan, 36 Church Street, and the other by Mr. Amos Hewitt, 26 School Street. Details will be given elsewhere under the several separate headings. After finding the infestations, the region immediately surrounding each was scouted two or three times to see if more larvae could be obtained.

For a portion of the time, the wages and expenses of the Federal scouts were paid from the insect pest appropriation granted to the Station for such work. In cleaning up around the seven infestations, both State and Federal men worked together. This arrangement made it possible to have the use of one of the Federal truck sprayers, designed for burning oil. The State paid for the oil, 5,485 gallons being used. For this purpose, fuel oil was purchased at eight cents per gallon. Burning operations were started on December 1, and completed December 12, 1924.

We desire here to express our appreciation and thanks to Messrs. L. H. Worthley, D. J. Caffrey, and their associates for the efficient and satisfactory co-operation and assistance which they have rendered to the State of Connecticut in this work.

Methods of Clean-Up Work.

The approved methods of clean-up work in and around small infestations of European corn borer, consist of burning all corn stalks, stubble and weeds. It is necessary to dig out the stubble which has been left after cutting the corn, and for this purpose a light mattock is a satisfactory tool. One blow will often dig the stubble from an entire hill, though in other cases it may require several blows, depending upon the number, size and distance apart of the stalks in the hill. On light soil where the corn is small, a potato hook is a handy tool for getting the stubble out of the ground. The roots should be shaken clean of soil as they will dry more readily, burn better and thus effect a saving in oil. Just before burning, the stubble should be raked into windrows or small piles. Shocks of corn may be burned just as they stand in the field.

The burning is greatly facilitated by using a power spray outfit so that the oil is under a pressure of between 150 and 200 pounds. It is conducted through a hose and thrown out through special triplex nozzles made for the purpose and placed on the end of a rod fitted with shut-off so that the operator may stop the flow when not needed (see Plate XXI, b.). The oil is ignited at the nozzles and makes a very hot fire. Corn stalks which are still rather green and contain a large amount of juice are soon heated to such a temperature that all larvae are killed. Dry stalks and weeds are entirely and almost immediately consumed. The entire field is gone over in this manner so that when completed, the field is black and nothing remains except a few charred pieces of corn stalks. All weeds around the margins of the field are also burned.

Bridgeport Infestation.

Hillside Home is the "poor farm" of Bridgeport and is situated on Bond Street just northeast of the city. The infestation was discovered by Federal scouts on July 24, 1924, when two larvae were found in smartweed in a corn field of about two acres near a spur railroad track. Later, October 23, one larva was found in this field in smartweed. The authors visited the place on this date in company with Mr. T. M. Cannon, of the Federal forces, to make plans for the clean-up. The corn had been harvested and put in the silo, and only some stalks, the high stubble and weeds remained. As we were short of help, we asked the Superintendent if he could have the stubble dug so that it would dry off before the time for burning, thinking that he would use some labor of the inmates for this purpose. He promised to do this, and we were greatly surprised when we went to burn, to find that he had tried to plow out the stubble. Some of it was partly plowed under, some loosened with large balls of earth, and most

of it was not disturbed at all. As there had been considerable rainy weather, the roots and stubble were not dry and were difficult to burn. Another corn field of about four acres across the spur railroad track and southeast of the infested field contained many weeds and was also burned over, making about six acres altogether burned over in the Bridgeport infestation. The burning was done on December 5, 8, 9, 10 and 11, and required 27 man days and 3,285 gallons of oil (see Plate XXI).

New Haven Infestation.

This infestation was in a small patch of sweet corn in the adjoining yards of Messrs. Edward W. Lovesey and E. Scandano, near the corner of Townsend and Forbes Avenues, commonly known as the Grannis Corners section. Two larvae were found in sweet corn August 25, 1924. A broom factory is located at 1180 Townsend Avenue and Mr. Lovesey's garden is directly back of the broom factory, though the land fronts upon Woodward Avenue. It is believed that the pest came here in imported broom corn as a number of burrows were found in the butts which had been trimmed off, and one dead larva was found in a burrow. There were also several small plots of sweet corn in adjacent yards altogether covering perhaps two acres. The corn had been cut, so the stubble was dug, and stalks, stubble and weeds burned. Some of the clippings from the broom factory had been dumped on Peat Meadow Road a short distance eastward, and we found exit holes of the borers in some of the clippings. These were all burned, together with all weeds in the vicinity, including those on the western side of the swamp. The stubble in the gardens was all dug in a half day by two men and the burning crew of six men completed the burning around the New Haven infestation in one day, using about 600 gallons of oil. The burning was done on December 4, 1924. (See Plates XXII and XXIII).

Old Lyme Infestation.

The infestation in Old Lyme was discovered on July 10, 1924, when one larva was found in a small corn field owned by Mr. Allen Way, beside the Four Mile River Road and about half-way between the shore road and the post road on the easterly side of the town. This field was surrounded on three sides by pasture and brush land and on the fourth side by the highway. Across the highway was more brush land. The field was about one-half acre in extent, and the corn had been cut and fed to cattle. The stubble was dug in a day by two men. Then it was raked together in a large pile, and this pile together with weeds all around the field was burned in one-half day by a crew of six men, using only about 100 gallons of oil, on December 12, 1924.

East Lyme Infestation.

This infestation was not discovered until November 15, 1924, when Messrs. Lantz and Habberly, Federal scouts, found four larvae in corn beside the west-bound railroad tracks, near the underpass close to the Crescent Beach railroad station. This corn was on Fairhaven Road and was owned by Mr. E. W. Russell. An adjacent field owned by Mr. Stone was near the original infestation and was also burned over. Mr. Russell had two fields:—one of two acres of late planted corn, grown as fodder for cows, another of about one acre of early sweet corn, the stalks of which had been cut and fed to cows. The corn in the larger field had been cut and placed in shocks.

Mr. Stone's corn was late sweet corn, about a half-acre in extent and was growing between the rows of young apple trees. The corn had not been cut, so had to be pulled and moved away from the apple trees before burning. There were also many large weeds which were burned.

In Mr. Russell's fields, the stubble had to be dug and raked together. Five men spent two days preparing these fields for burning and six men did the burning on December 2, 3 and 12 in two and one-half days, using 1,300 gallons of oil.

Groton Infestation.

At this infestation, Federal scouts discovered seven larvae in sweet corn, July 28, 1924, on land owned by Mr. Frank J. Burnham on North Road, about three-fourths of a mile north of the Groton Town Hall. The corn was evidently fed to livestock so that there was little to burn, but on December 1, the bits of stalks as well as the weeds on the land and especially around the edge of a swamp were burned, using 100 gallons of oil.

Stonington Infestations.

Both infestations in Stonington were discovered by Federal scouts on August 4-5, 1924, and these were both on the easterly side of the village of Mystic. One was in the garden of Mr. Henry W. Morgan, 36 Church Street, where two larvae and six pupae were found in corn, and the other was in the garden of Mr. Amos G. Hewitt, 26 School Street, where also two larvae and six pupae were found in the stalks of sweet corn.

The stubble and large weeds in both gardens were dug in one day by two men and left about two weeks to dry. The burning was done on December 1, in about one-half day, and 100 gallons of oil were used. Some corn and weeds in a yard adjoining Mr. Hewitt's were burned at the same time, altogether covering perhaps an acre of ground in Stonington.

Summary of Clean-Up Work.

The clean-up work may be summarized in the following table:

Towns Infested	No. Acres	Time Digging Stubble-Days	Time Burning Man Days	Date of Burning	Oil Used Gallons
Stonington.....	1	2	3	Dec. 1	100
Groton.....	1	0	3	Dec. 1	100
East Lyme.....	3.5	10	15	Dec. 2, 3, 12	1,300
Old Lyme.....	.5	2	3	Dec. 12	100
New Haven.....	2	1	6	Dec. 4	600
Bridgeport.....	6	0	27	Dec. 5, 8, 9, 10, 11	3,285
Total.....	14	15	57		5,485

Repeal of Quarantine.

At a conference held in Washington, D. C., April 28-30, 1924, at which many officials of the eastern states, Federal Horticultural Board, and United States Department of Agriculture were present, the whole subject of quarantines was considered and recommendations adopted. It was the sentiment of the conference that quarantines should not be established by states against other states when action on the subject has been taken by the Federal Horticultural Board fully covering the matter. The Federal quarantines are generally considered to control inter-state shipments and not those from one point to another within the bounds of a state.

The Connecticut quarantine against the European corn borer was first established, and became effective September 20, 1918. This was revised to include additional territory found to be infested, and Quarantine Order No. 3 was issued, effective June 1, 1920. A further revision was made in Quarantine Order No. 5, effective June 1, 1923, relating to this insect.

Up to this time, these three quarantine orders issued because of the European corn borer, placed restrictions only on shipments entering Connecticut from the infested territory in eastern New England, New York, Pennsylvania, Ohio and Michigan, as no infested territory had been discovered in Connecticut, and could not, therefore, be placed under quarantine. It was evident that our quarantine would be regarded as a restriction placed by a state upon inter-state commerce, and would probably be declared unconstitutional if it came to a test. Moreover, the State of Connecticut had been adequately protected by the Federal quarantine. Consequently the following order was issued:

STATE OF CONNECTICUT

OFFICE OF

AGRICULTURAL EXPERIMENT STATION.

NEW HAVEN, CONN.

QUARANTINE ORDER No. 7.

Effective July 1, 1924.

Whereas, Quarantine Order No. 5, issued from this Office effective June 1, 1923, on account of the European corn borer, *Pyrausta nubilalis* Hubner, prohibited certain portions of corn and other plants from infested regions of Maine, New Hampshire, Massachusetts, Rhode Island, New York, Pennsylvania, Ohio and Michigan, from being brought into Connecticut, the following memoranda may be recorded:

1. That all regions where this insect now exists are under Federal Quarantine.
2. That Connecticut is therefore duly protected by Federal Quarantine.
3. That no portion of Connecticut has been placed under Federal Quarantine on account of the European corn borer.
4. That it was the voice of the quarantine conference at Washington, D. C., April 28-30, 1924, that States should not establish quarantines against other States when the subject has been fully covered by Federal action.
5. That the Federal Quarantine takes precedence in such cases where there is a seeming conflict, and the State quarantine is null and void.
6. That the present case in no way prejudices future action regarding an intrastate quarantine, when it has been found that a portion of the State has become infested.

The present European corn borer regulations (Quarantine Order No. 5) are hereby repealed.

This order shall take effect July 1, 1924.

W. L. SLATE, Jr., Director,
Connecticut Agricultural Experiment Station.

Approved:

CHARLES A. TEMPLETON, Governor.

FURTHER WORK NEXT SEASON.

It will be necessary to do considerable scouting work next year, around these infestations to see if any traces of the pest can be found. Probably it will also be best to rescout the same or similar territory each year to make sure that the European corn borer has not established itself. Various sections of the State will also need to be scouted where there may be danger of infestation or to protect some local vegetable or seed growing industry.

Anticipating work of this nature, an item of $5,000 was placed in the budget of the Station for the next fiscal period, to defray the cost of work against the European corn borer. At this writing it seems doubtful if this will be enough, as more than half as much has already been expended against this insect in the single season of 1924.

INSECTS FOUND ON TWIGS OF FRUIT TREES.

In February, 1924, the officers of the Connecticut Pomological Society requested that the Station give additional services to fruit grower members of the Society by furnishing definite and timely information and advice regarding spray treatment for the various insects and diseases found in Connecticut orchards. After a full consideration of the matter, it was decided to attempt this project and of course the work naturally belongs in the Departments of Entomology and Botany.

It was decided that we needed more data on exact conditions in the various orchards, and that some data could be gathered by personal visits, but that orchardists should send in suspected twigs for examination and report. Messrs. Zappe, Garman and Stoddard visited several orchards, examined the trees for pests, made notes, and in some cases brought back twigs for microscopic examination. Orchardists also cut and sent twigs which were examined for insects in the laboratory by Dr. Philip Garman. In this manner, twigs from 18 different apple orchards were given this laboratory examination and the results afterwards reported to the owners or managers. The result of this examination as regards insects on apple is shown in the following table:

Insect Inhabitants

Examined March

H—Heavy, M—Medium, L—Light.

Name and Locality	Date	European red mite eggs	Oyster-shell scale	Woolly aphid galls
Hale Orchard Co., Seymour	Mar. 7	Baldwin—H. McIntosh—L.	Baldwin—H.	Baldwin—L. Greening—L.
C. L. Gold, West Cornwall	10	0	McIntosh—L.	McIntosh
W. F. Platt, Milford	10	Baldwin—L. McIntosh—L. Fall Pippin—L. Greening—L.	Greening—L.	Greening—L. Fall Pippin—L.
C. E. Lyman Estate, Middlefield	11	Baldwin—L. McIntosh—L. No. Spy—L. Fameuse—L. Ben Davis—L.	0	Baldwin—L. McIntosh—L. Fameuse—L. Ben Davis—L.
E. Rogers & Son, Southington	12	Baldwin—H. McIntosh—L.	0	Baldwin—L. McIntosh—L.
E. M. Ives, Meriden	12	Baldwin—L. McIntosh—L.	0	McIntosh—L.
Frank N. Platt, Milford.	14	Baldwin—L. Other var.—L.	0	Baldwin—L. Other var.—L.
L. H. Warncke & Son, Cannondale	15	Baldwin—M. Greening—L.	Greening—L.	Baldwin—L. Greening—L.
Conn. Agr. College, Storrs	17	Baldwin—L. McIntosh—L. Fall Pippin—M. Winesap—M.	0	Baldwin
J. H. Hale Co., So. Glastonbury	18	Var. ?—L.	0	Var. ?—L.
L. C. Root & Son, Farmington	19	Baldwin—H. McIntosh—M. Fall Pippin—L.	0	Baldwin McIntosh
Mountain View Orchard Co., Hazardville	20	Baldwin—H. Greening—L.	0	Greening—L.
A. F. Greene, Middlebury	22	McIntosh—L. Other var.—L.	0	Other var.—L.
Walter H. Baldwin, Cheshire	22	0	0	Baldwin—L. Wagener—L. Sutton—L.
Conyers Farm, Greenwich	25	McIntosh—L. Gravenstein—L.	0	McIntosh—L. Gravenstein—M. King—L.
Conn. Valley Orchard Co., Deep River	27	0	0	King—L. Russet—L.
Gulley & Son, Rockville.	Apr. 1	Fall Pippin—L.	0	McIntosh—L. Fall Pippin—L.
S. A. Smith & Son, Clintonville	14	Delicious—L.	0	McIntosh—L.

OF APPLE TWIGS.

AND APRIL, 1924

Bark Miner Tunnels	Rosy aphid eggs	Buffalo tree hopper eggs	Ormenis sp. eggs	Tent-caterpillar egg-masses	Name
Baldwin Delicious	0	0	Greening*	0	(Hale)
0	0	0	0	0	(Gold)
McIntosh Fall Pippin	Baldwin—L. McIntosh—L. Fall Pippin—L. Greening—L.	0	0	0	(Platt)
Baldwin No. Spy	McIntosh	0	0	1 on Fameuse	(Lyman)
Baldwin	0	0	0	0	(Rogers)
McIntosh Other vars.	0	0	0	0	(Ives)
Baldwin Other var.	Baldwin Other var.	0	Other var.	0	(Platt)
0	Greening—L.	Greening	0	1 on Greening	(Warncke)
0	0	No. Spy	0	0	(College)
Var. ?	Var. ?—L.	Var. ?—L.	Var. ?—L.	0	(Hale)
Baldwin McIntosh Fall Pippin	0	0	0	0	(Root)
0	0	0	0	0	(Mt. View)
McIntosh Other var.	McIntosh	0	0	1 on McIntosh	(Greene)
0	0	McIntosh	0	0	(Baldwin)
0	0	0	McIntosh	0	(Conyers)
King Russet	0	0	0	0	(Conn. Valley)
McIntosh Gravenstein	Wagener—M. Fall Pippin—L.	0	Wagener Gravenstein	0	(Gulley)
0	0	McIntosh	McIntosh Delicious	0	(Smith)

* Also a few cigar cases of *Coleophora*.

In addition to the apple twigs examined, some peach and pear twigs were also received and examined. Thus Elberta peach twigs from the Hale Orchard Co., Seymour; peach twigs from E. Rogers & Son, Southington; Elberta from L. H. Warncke & Son, Cannondale; peach twigs from the Connecticut Agricultural College, Storrs; Elberta from the Mountain View Orchard Co., Hazardville; Hiley from Conyers Farm, Greenwich; Stump, Elberta and another variety from the Connecticut Valley Orchard Co., Deep River; and Mountain Rose, Belle of Georgia, Carman and Elberta, from Gulley & Son, Rockville, exhibited no pests. Elberta from W. F. Platt & Son, Milford, from the C. E. Lyman Estate, Middlefield, and Hale, Elberta and Greensboro from L. C. Root & Son, Farmington, showed eggs of the European red mite, *Paratetranychus pilosus* C. & F., though the infestations were light in all cases. One of the peach twigs from Milford showed evidence, though not unmistakable proof, that it had been attacked by the Oriental peach moth, *Laspeyresia molesta* Busck.

Pear twigs from the Connecticut Agricultural College had been infested with pear psylla, *Psylla pyricola* Foerster, and twigs from Conyers Farm, Greenwich, contained some insect eggs not familiar to us, possibly laid by Membracids or treehoppers. Twigs from the J. H. Hale Orchard Co., were marked with scars caused by hail during 1923.

In case of woolly aphid, *Eriosoma lanigerum* Hausm., galls on the twigs and the waxy exudation were the only evidence. In all other cases except the case bearer, all insects on the apple twigs were in the egg stage.

It is rather surprising and withal somewhat significant that in examining these twigs from 18 different orchards from three-fourths of the Counties of the State (only Windham and New London not being represented) that not a single San José scale, *Aspidiotus perniciosus* Comst., was found.

DUSTING VERSUS SPRAYING.

Season of 1924.

M. P. Zappe and E. M. Stoddard.

The experiments to determine the relative value of dusting and spraying which were begun in 1920 were continued in 1924. While it has been demonstrated that the best grade of apples are grown by spraying, there is considerable value in dusting, especially in dry years. In addition to the plots receiving either spray or dust, we have had during 1924 plots which were both sprayed and dusted.

The results of previous years work have been published as follows: Report for 1920, page 168, results of 1920; Bulletin 235, results of 1921; Bulletin 245, results of 1922; Report for 1923, page 267, results of 1923.

Orchards Under Experiment.

The two orchards used in these experiments were both used in former experiments. One was located in Milford, the orchard of F. N. Platt, and contains 285 trees about 20 years old. The other was the old orchard at the Experiment Station Farm at Mount Carmel. This orchard is about 48 years old and consists of 40 trees, mostly Baldwins and Greenings.

Acknowledgments.

The writers are indebted to Mr. Frank N. Platt of Milford for the use of his orchard, power sprayer and assistance in conducting these experiments, and also to Messrs. George Graham, J. L. Rogers, B. H. Walden, P. Garman, T. F. Cronin and H. F. Bender, who helped in the applications of treatments and in harvesting and scoring the fruit.

Apparatus Used.

The spray outfit was the same as used in the preceding experiments, a 200 gallon Friend power sprayer, carrying two lines of hose with rods and nozzles at about 200 pounds pressure. The duster was a 1923 model Niagara power outfit mounted on an automobile truck.

Spraying and Dusting Materials Used.

Liquid Spray.

Lead arsenate	3 pounds
Dry lime-sulphur	6 pounds
Casein spreader	1 pound
Nicotine sulphate	¾ pint
Water	100 gallons

Sulphur-Lead Arsenate Dust.

Sulphur	90%
Lead Arsenate	10%

Green Copper Dust.

Metallic Copper	6%
Metallic Arsenic	3%

Blue Copper Dust.

Metallic Copper	3.74%
Metallic Arsenic	1.76%

Number and Time of Applications.

Six applications of spray and dust were made in the Platt orchard at Milford, beginning with the prepink treatment on McIn-

tosh only. The owner gave the entire orchard an oil spray when the buds were beginning to open. In this orchard, leafhoppers were very plentiful on the dusted plots so these plots were given an application of nicotine dust on June 2.

Prepink treatment (McIntosh only)	May 1
*Pink treatment	May 7–8
*Calyx treatment	May 28
*First after calyx treatment	June 11–12
Second after calyx treatment	July 8–9
Third after calyx treatment	August 6

Plots.

The Platt orchard in Milford was divided into seven plots as shown in Table I. The first three rows (A, B and C) were sprayed; the next three (D, E and F) were dusted with 90-10 sulphur-arsenate dust. The north half of rows G, H and I was treated with green copper dust, while the south half was treated with blue copper dust. The north half of rows J, K and L was treated as follows: prepink, pink and calyx, with spray; first and second after calyx, with 90-10 dust; third after calyx, with spray (combination No. II). The south half of the same rows was treated as follows: prepink and pink, sprayed; calyx and three other applications were of 90-10 dust (combination No. I). Rows M and N were left untreated for a check against the treated plots.

Table 1.

Treatments	Plot 1 Rows ABC	Plot 2 Rows DEF	Plot 3 Rows No. half GHI	Plot 4 Rows So. half GHI	Plot 5 Rows No. half JKL	Plot 6 Rows So. half JKL	Plot 7 Rows MN	
Prepink	Spray	90–10 dust	Green copper dust	Blue copper dust	Spray	Spray	Check	McIntosh variety treated
Pink	Spray	Dust	Dust	Dust	Spray	Spray	Check	All varieties
Calyx	Spray	Dust	Dust	Dust	Spray	90–10 dust	Check	All varieties
1st after calyx	Spray	Dust	Dust	Dust	90–10 dust	90–10 dust	Check	All varieties
2d after calyx	Spray	Dust	Dust	Dust	90–10 dust	90–10 dust	Check	All varieties
3d after calyx	Spray	Dust	Dust	Dust	Spray	90–10 dust	Check	All varieties

Plot 1—Sprayed
Plot 2—90–10 sulphur-arsenate dust
Plot 3—Green copper dust
Plot 4—Blue copper dust
Plot 5—Combination Plot No. 2
Plot 6—Combination Plot No. 1
Plot 7—Not treated—checks.
Checks on all varieties have had no treatment in last four years.

* Nicotine in liquid spray.

TABLE 2.

RESULTS OF TREATMENTS ON McINTOSH.

MILFORD ORCHARD.

	Spray	90–10 Sulphur-arsenate Dust	Green Copper Dust	Blue Copper Dust	Combination 1 South	Combination 2 North	Check
Good	84.3	74.4	68.9	60.5	52.4	60.0	4.4
Scab	6.3	14.4	15.0	24.9	26.5	25.4	71.5
Aphis	2.95	5.5	6.03	3.64	7.3	7.4	10.2
Red bug	3.62	1.9	6.9	6.69	8.94	7.16	20.3
Codling moth	.43	.56	.55	.81	1.38	.44	4.01
Curculio	1.26	1.66	1.66	3.1	6.6	4.01	37.0
Other chewing insects	1.37	2.58	2.72	3.25	3.76	2.02	3.71
Sooty blotch	0	.02	0	Trace	Trace	0	Trace

DISCUSSION OF RESULTS.

The sprayed plot gave the highest percentage of good fruit and the 90-10 dust plot came next. The copper dusts were not so good as the 90-10 sulphur-arsenate dust in control of scab. Neither of the combination treatments were as efficient as the spray, the sulphur or the green copper dusts, combination No. 2 being on a par with the poorest of the copper dusts. The plots receiving the combination treatments were at the lower edge of the orchard just east of a woodlot and the trees were in a copper dust plot last year where there was much scab, which may possibly account for the large amount of scab present this season.

TABLE 3.

RESULTS OF TREATMENTS ON BALDWIN.

MILFORD ORCHARD.

	Spray	90–10 Sulphur-arsenate Dust	Green Copper Dust	Blue Copper Dust	Combination 1 South	Combination 2 North	Check
Good	85.9	87.2	86.5	86.5	79.0	85.5	No fruit
Aphis	9.65	8.2	8.5	6.03	15.4	8.1	No fruit
Red bug	2.2	.49	.2	.44	.6	1.42	No fruit
Codling moth	.01	.52	.68	1.88	1.53	.35	No fruit
Curculio	.69	1.1	1.71	.89	1.47	2.2	No fruit
Other chewing insects	1.7	2.4	2.82	4.55	2.4	2.4	No fruit
Scab	0	0	0	Trace	0	0	No fruit
Sooty blotch	0	0	.18	0	0	.14	No fruit

DISCUSSION OF RESULTS.

There is very little difference in any of the plots of this variety. Combination plot number one was lower in the percentage of

good fruit than the other plots; this was caused by a higher percentage of injury by aphids. The Baldwin trees in the check rows bore no fruit.

TABLE 4.

RESULTS OF TREATMENTS ON GREENING.

MILFORD ORCHARD.

	Spray	90–10 Sulphur-arsenate Dust	Green Copper Dust	Blue Copper Dust	Combination 1 South	Combination 2 North	Check
Good	75.0	81.0	68.4	68.4	70.0	62.2	10.7
Aphis	22.3	12.9	23.5	23.9	21.0	30.8	5.9
Red bug	.66	.66	1.17	1.17	2.6	6.0	62.5
Codling moth	.63	1.19	1.29	1.05	1.65	.62	4.99
Curculio	.78	2.18	2.62	3.06	2.9	5.7	21.9
Other chewing insects	.726	1.6	1.92	2.82	1.7	2.52	3.44
Scab	.21	.66	2.2	1.56	.95	2.76	27.9
Sooty blotch				.37		1.99	6.83

DISCUSSION OF RESULTS.

In the Greening plots the sulphur-arsenate dust was a little better than the liquid spray. The copper dusts averaged a little more good fruit than the plots receiving a combination treatment. In the check plot the fruit was badly deformed by red bugs and aphids and most of this injury was scored as red bug work, but a good share of it was undoubtedly caused by aphids; probably much more than the figures show. The variation in amount and control of scab was so small between the different treatments that a choice can hardly be made as can easily be done on the McIntosh.

TABLE 5.

RESULTS OF TREATMENTS ON GRAVENSTEIN.

MILFORD ORCHARD.

	Spray	90–10 Sulphur-arsenate Dust	Blue Copper Dust	Combination 1 South	Check
Good	66.2	74.6	75.9	75.3	37.5
Aphis	29.8	22.2	17.5	18.3	31.9
Red bug	.518	1.02	.4	.38	2.74
Codling moth	.28	.05	.23	.31	.98
Curculio	1.8	1.4	1.71	2.78	22.07
Other insects	.97	.9	1.44	1.67	3.82
Scab	.61	2.35	2.99	1.05	13.34
Sooty blotch			.08	.105	2.53
Fruit speck			.13	.005	.239

Discussion of Results.

The Gravenstein trees are located on only one side of the orchard: therefore there were none in the green copper plot nor in the combination plot number two. The sprayed plot gave the lowest percentage of good fruit because the aphis injury was high on the fruit of this plot. Between the other three treatments there is very little choice, as they produced about the same amount of good fruit. In amount of scab, the sprayed plot was a little lower than the others, the highest percentage except for the check being in the blue copper dust plot. The blue copper dust and combination No. 1 plots showed a small percentage of sooty blotch and fruit speck.

Mount Carmel Orchard.

The old orchard at the Experiment Station Farm was divided into two plots. The first application in this orchard was the calyx treatment followed by three others. As there were no varieties in this orchard that were very susceptible to scab, we felt that the prepink and pink treatments could be omitted.

Treatments	Plot 1	Plot 2	Dates of Applications
		90–10	
Calyx	Spray	Dust	May 29
1st after calyx	Spray	Spray	June 13
	90–10		
2d after calyx	Dust	Spray	July 9
	90–10		
3d after calyx	Dust	Spray	August 7

The spray applications in this orchard were applied with an Arlington X. L. Sprayer, using two lines of hose with two nozzles at each rod. The duster was the same as used in the other orchard.

The applications of dust in both orchards were usually put on either in late afternoon or in morning before dew had dried or wind had begun to blow.

The check trees bore no fruit so no data was obtained.

Table 6.

Results of Treatments on Baldwin.

Mount Carmel Orchard.

	Plot 1 16 trees	Plot 2 4 trees
Good	81.1	67.4
Aphis	11.6	22.1
Red bug	.03	.16
Codling moth	.56	1.02
Curculio	5.27	8.17
Other chewing insects	1.66	3.5
Scab	.04	.03

Discussion of Results.

Plot 1 having first two treatments of liquid spray gave better control of all pests and therefore produced a higher percentage of perfect fruit.

Table 7.

Results of Treatments on Greening.

Mount Carmel Orchard.

	Plot 1 6 trees	Plot 2 7 trees
Good	62.56	54.38
Aphis	14.27	20.72
Red bug	.12	.14
Codling moth	1.66	1.3
Curculio	19.3	22.65
Other chewing insects	2.78	4.55
Scab	4.68	2.84
Sooty blotch		.01
Cedar rust		.11

Discussion of Results.

As in the Balwin plot in this orchard, the treatment on Plot 1 gave a higher percentage of good fruit than Plot 2. The percentage of aphid and curculio injury was much higher on this variety than on the Baldwin. Scab injury is also a little more evident.

Summary.

On the McIntosh, chiefly due to scab control, the liquid spray was 10 to 30 per cent. better than any of the other treatments, with 90-10 sulphur-arsenate dust a close second. The application of nicotine in the spray gave very good control of leafhoppers but the one application of nicotine dust gave in most cases better control of aphis than did the three applications of nicotine spray. This is shown by the fact that in every case where dust gave more perfect fruit than spray, the difference was due to aphis control.

On Baldwin, Greening and Gravenstein, aphids were the controlling factor in the production of perfect fruit. Where aphids were controlled by the treatment or were absent for some other reason, the per cent. of perfect fruit was correspondingly high and vice versa, a high per cent. of aphids lowered the per cent. of perfect fruit. Other insects were controlled about equally well by all the treatments and due to the dryness of the season after June 1, fungi did not develop sufficiently to be important.

At the Mount Carmel orchard, the combination plot (having the calyx and the first treatment after the calyx with liquid spray) was the best on both Baldwin and Greening. Here as in the other orchard aphids were responsible for the largest amount of injury. Curculio ranks next in amount of injury in this orchard.

SUMMARY OF FIVE YEARS WORK ON SPRAYING AND DUSTING.

M. P. ZAPPE AND E. M. STODDARD.

In order to show the relative merits of spraying and dusting as determined by the results of our experiments during the years 1920 to 1924 inclusive, we here present a summary in which are brought out the points that seem to have been demonstrated in these particular experiments. We have included some other interesting features in regard to the occurrence and control of insect and fungous pests.

In the preparation of these data we have scored 564,675 apples, chiefly of four varieties, McIntosh, Greening, Gravenstein and Baldwin, in four different orchards in the vicinity of New Haven.

The following table gives the average results in per cent. for all the spraying, dusting and checks on all varieties for the five years indicated above. In this table "other fungi" includes sooty blotch, fruit speck, rust, black rot and bitter rot. "Other chewing insects" includes the various chewing insects other than are listed which attack the fruit of apples.

Treatment	Good	Scab	Other Fungi	Aphis	Red Bug	Curculio	Codling Moth	Other chewing insects
	%	%	%	%	%	%	%	%
Spray...	68.6	14.7	6.05	10.0	1.3	17.7	.94	1.8
Dust....	41.4	30.2	28.4	10.7	2.6	21.8	1.4	4.7
Check...	12.2	40.5	34.8	9.7	12.8	48.6	11.7	9.8

It would seem from these figures that dusting is practically as good as spraying for the control of red bug, curculio, codling moth, and other chewing insects, but in the control of fungi there is a wide variation in favor of the spraying. Aphids have not been controlled by either treatment, in fact the checks show the least amount of injury. It is evident that aphids and curculio cause the greatest amount of insect injury on treated trees and are the most difficult to control.

Scab took the largest toll of all the fungi, with sooty blotch and fruit speck ranking next, these latter making up the greater part of the injuries listed in the table as "other fungi." Rust, black rot and bitter rot are so rare as to be negligible on the varieties included in the orchards in this study.

In the study of the data it was found that scab was the least prevalent in 1920, which year had the largest amount of rain of all of the five years, and in 1921-22-23-24 which had normal rainfall or less than normal, the per cent. of scab was higher by 50 to 70%. These computations were made on the data from check trees which represent the actual amount of scab present in the orchard, and were not influenced by variations of treatment. A study of the weather conditions during April, May and June of

these years showed that in 1920 the periods of high humidity were very short, the per cent. of humidity dropping immediately and sharply after a rain, while in the other years the humidity dropped slowly after rains, sometimes lagging over three or four days, and very light rains were often accompanied by high and sustained rises in humidity.

Further study will be necessary to establish this apparent relation to per cent. of humidity rather than actual rainfall, but it would seem that better results from spraying would follow if it be done before or during sustained periods of high humidity rather than before rains. It is our belief that a close study of the weather conditions is a safer guide for the orchardist to follow than information as to time and duration of spore discharge, because it is safe to suppose that sufficient spores will always be discharged to cause a damaging amount of infection if weather conditions are suitable for such infection and if the trees are protected during optimum periods for infection the desired control will be obtained. Inability to predict these conditions accurately will necessitate spraying a certain number of times as insurance, timing them as near as possible to give maximum protection.

Our data show that McIntosh is the most severely attacked by scab of the varieties used in the experiments, but the amount of injury from all other insect and fungous pests is considerably less than on the other varieties. Baldwin is the least susceptible to scab but much more susceptible to sooty blotch and fruit speck, and in most cases shows more curculio injury. Gravenstein is most severely injured by aphids of all the varieties observed.

TESTS OF INSECTICIDES FOR THE CONTROL OF THE ASIATIC BEETLE.

Anomala orientalis Waterhouse.

M. P. Zappe and P. Garman.

This insect has caused considerable injury to lawns in the western part of the City of New Haven, in the vicinity where the adults of this insect were first collected on July 16, 1920. In some cases sections of lawns equivalent to 60 square yards and smaller have been ruined by the larvae or grubs, as they are commonly called, which devoured the roots of the grass. Where the infestation is heavy, the turf may be rolled up like a carpet. Many of the property owners have spaded up the infested sections, collected, and killed all the grubs they could find, afterwards reseeding their lawns. During the summer of 1924, tests of several insectides and methods of their application were made to determine which of these are the most practicable and efficient in controlling this insect in the larval stage in lawns. So far as we know, this pest has not been troublesome in gardens, with

the exception of one case where a few grubs were found in a strawberry bed near a badly infested lawn.

Previous accounts of this insect in Connecticut have been published in the Report of this Station for 1922, page 345, and for 1923, page 291.

Calcium Cyanide.

This material was used on lawns in several tests at strengths varying, from four to six ounces per square yard. It is a coarse dust containing from 40 to 50 per cent. of calcium cyanide, and is very poisonous, not only when taken internally, but when the gas is inhaled. The soil where all tests were made was a type of light sandy loam.

Two plots were laid out on an infested lawn; one containing 20 square yards was treated with calcium cyanide at the rate of four ounces to the square yard, the other containing 60 square yards was given a dosage of six ounces per square yard. The cyanide dust was applied to the lawn as evenly as possible with a hand fertilizer drill, after which the ground was thoroughly wet down with a garden hose to wash the cyanide into the soil. (See plates XXIV, b and XXV, a).

Before applying the cyanide, a square foot of soil was dug up and all larvae were counted. There were 63 larvae in this square foot of soil, most of them being in the upper three inches among the grass roots, although a few were found six inches deep. Other sections were also dug, and found to be similarly infested.

Prior to our treatment of this lawn, the owner had spaded part of it and what sod was left had been turned under, so that it was buried four or five inches deep. The treatment was applied on May 14. On May 19, many of the grubs were dead in both plots, but in that portion of the lawn which had been spaded, before treatment, most of the live grubs were in the sod which had been turned under, and were too deep to be killed by the cyanide.

A good kill was obtained on that portion of lawn which had not been spaded, and practically all of the dead larvae were in the first two inches of soil; below this depth there were quite a number of living ones. All grass on the treated portion of lawn was badly burned by the cyanide.

Both plots were treated as one on May 31, with calcium cyanide, using about five ounces per square yard. This time the ground was spaded after the application, then immediately treated again, and watered thoroughly. On this date the wind was quite strong and blew some of the cyanide dust upon rose bushes, Spiraea and Weigela. Nearly all the leaves on the rose bushes were so badly injured that they dropped off, and the Spiraea and Weigela were also injured, though not so badly as the roses. The

roses were not killed, as they produced a new set of leaves in a short time.

A few days later an examination of this plot was made and it was found that about a 100 per cent. kill had been obtained. On May 19, several small wire cages containing three larvae and a small piece of sod each, were buried in small holes in the ground at the following depths from the surface; one hole with two cages, one three inches, the other six inches deep; another hole with cages at five inches and another seven to nine inches deep; and one hole with cage four inches deep. One ounce of cyanide was then placed in a hole eight inches deep and six inches from the holes containing the buried cages of larvae, and covered with soil.

An examination made a week later gave the following result:

Depth Buried Inches	No. Alive	No. Dead
3	3	0
5	2	1
6	3	0
7 to 9	2	1
4	3	Not treated

On another lawn, a plot one yard square was selected and holes made with a crowbar about six inches deep and 12 inches apart; each hole was dosed with one-third ounce of calcium cyanide. After the cyanide was put into the holes, they were filled up with earth. Another plot of two square yards was treated in a similar manner, except that the holes were made two feet apart and were dosed with one ounce of cyanide. An examination of the plots a few days later showed practically no kill of larvae on either plot.

A similar test was made at another place, using one ounce of calcium cyanide, placed at the bottom of a hole four inches deep and three inches in diameter, made by a sod cutter. The cyanide was covered with soil. Other holes the same size and shape as the cyanide hole were made at varying distances from them and an *Anomala* larva in a small wire cage buried in each hole. Eight holes with a larva in each one were made near the hole containing the cyanide. The cyanide and larvae were placed May 28, and examined June 11.

*No. Inches from Cyanide Hole	No. Alive	No. Dead
6	1	1
9	2	0
12	2	0
18	2	0

It may be seen from the tests that the application of calcium cyanide by the hole method was not a satisfactory method of

* Two holes at each distance.

control for *Anomala* larvae. This method has the advantage of not killing the grass. By the broadcast method of application, a good kill of larvae resulted, but the grass was very badly burned. The men broadcasting the cyanide experienced a disagreeable dryness and hoarseness of the throat as well as headaches. More serious effects might be felt if operators were exposed to the action of the cyanide for a longer time. For these reasons it was thought best not to recommend this material for general public use in the control of this insect.

Sodium Cyanide.

This is the ordinary cyanide used in combination with sulphuric acid and water for the fumigation of houses, greenhouses, warehouses, etc., for the control of various insects infesting places that are or can be made air tight. For the control of *Anomala orientalis*, a certain amount of cyanide was dissolved in water and sprinkled on the lawn to be treated, afterward wetting down thoroughly with water from a garden hose.

Three plots were treated with sodium cyanide, using one-eighth, two-eighths, and three-eighths ounces per plot of one square yard. Cyanide was applied as described in the above paragraph. A few days later the plots were dug up and all larvae collected, with the following result:

Ounces per Square Yard	No. Alive	No. Dead
One-eighth	19	4
Two-eighths	6	12
Three-eighths	12	9

Further tests with sodium cyanide were conducted by burying five larvae in a wire cage in the center of a plot one yard square in area. The cyanide was applied as before, dissolved in water and sprinkled on plots with a watering can, then watered with garden hose.

Ounces per Square Yard	No. Alive	No. Dead	Remarks
One-half	5	0	Grass partly killed
Three-fourths	0	5	Grass all killed
One	0	5	Grass all killed

Another plot of 24 square yards was treated with sodium cyanide using one ounce per square yard dissolved in water and applied to the lawn in the usual manner. Treatment was made on June 11, and on June 17, the plot was examined and approximately 90 per cent. of the larvae had been killed. Most of the larvae that were left alive were found rather deep in the soil. The grass on this plot was all killed.

Other insecticides were tried on a small scale to determine their effect upon *Anomala*. Mercuric chloride was tested on a plot of 11 square feet, using one-tenth ounce of this chemical.

It was dissolved in water and sprinkled on the soil, but gave only one per cent. kill.

A 10 per cent. kerosene emulsion applied to a plot one yard square was worthless, as no dead larvae were found when the plot was examined a few days after the treatment.

Carbon Disulphide Emulsion.

The most promising of the insecticides and soil fumigants tested was carbon disulphide emulsion. There is a commercial carbon disulphide emulsion on the market which is sold under the name of Kokotone. This was first used on plots one yard square; in the center of each plot a wire cage was buried containing *Anomala* larvae. Each cage was buried between two and three inches deep. The plots were dosed with one-half pint, one-fourth pint and one-eighth pint of Kokotone. The amount of emulsion to be used on each plot was first diluted in about three gallons of water and then sprinkled on the lawn with a watering pot (Plate XXIV, a) then the ground was soaked with more water from a garden hose to wash the emulsion into the ground. On digging up the cages containing the *Anomala* larvae two days later, it was found that in each plot all the larvae had been killed. The grass was slightly injured on the plots receiving one-half and one-fourth pint of emulsion, but the one-eighth pint plot was not noticeably hurt. All the grass which was burned recovered after a short time.

Another lawn of 32 square yards was then treated with Kokotone using one-eighth pint per square yard, applied in the same manner. Four days later, June 30, the lawn was dug into and 61 dead larvae and pupae were found, also two dead adults. In another place a bunch of tall grass under a Spiraea bush was dug up and five dead pupae and two living larvae were found. This amounts to about a 97 per cent. kill. Grass on this plot was slightly injured but soon recovered.

Kokotone was again used late in the fall on a plot of lawn the same size as above. The amount of Kokotone used and the method of application was the same as on the above plot. The temperature of the air was much lower than on June 30, and the soil temperature was 67° F. This probably accounts for the fact that we found only about a 70 per cent. kill when the lawn was examined on October 9. The gas from the carbon disulphide is apparently not given off fast enough at low temperatures to give a high percentage of kill.

It is also apparent from the work done thus far that it is important to saturate the soil with water after the emulsion is applied in order that it may reach and surround the grubs. It works both as a contact insecticide and as a fumigant when applied in this manner.

Home made carbon disulphide emulsion was prepared after a formula given by Leach and Thomson[1] in an article on the "Control of Japanese Beetle Larvae in Golf Greens." This formula calls for 12.5 grams of resin-fish-oil soap dissolved in 87.5 cubic centimeters of water. This is heated until the soap is dissolved, then the solution is allowed to cool, after which 250 cc. of carbon disulphide is added and the mixture agitated until a white creamy emulsion is obtained. We have found that a fairly stable emulsion can be made by substituting either fish-oil-soap or the ordinary naphtha laundry soap for the resin-fish-oil soap, and is satisfactory for immediate use.

Two plots of one square yard each were treated with this emulsion, one made from fish-oil soap and the other from naphtha laundry soap. In the center of each plot before treatment a small wire cage containing two *Anomala* larvae was buried about two or three inches deep. Two liquid ounces of emulsion were used on each plot diluted with three gallons of water and then watered with five gallons of clear water. On examination a few days later, all larvae were found dead. The grass was not injured.

STUDIES OF THE HABITS AND CONTROL OF THE ORIENTAL PEACH MOTH IN 1924.

PHILIP GARMAN.

The Oriental peach moth showed up again in Connecticut in 1924 and was on the whole more abundant than in previous years. It appeared for the first time in appreciable numbers in the peach growing district about Wallingford where a number of growers reported its presence. It was found largely in the southwestern section of the State and in the central section extending northward from New Haven into Hartford County. One orchardist near the Massachusetts line stated that he had seen "worms" in his peaches similar to those of the Oriental peach moth, but this locality is well to the north of the main infestation and its presence should be observed another year in the same locality in order to make sure that it has become established. A questionnaire sent out in October to about 20 peach growers indicated that the insect was present in 11 of their orchards, but most of those reporting it were of the opinion that it did little damage. In the orchard at Conyers Farm, Greenwich, about the same amount of damage as occurred last year was observed by the men in charge, but the possibilities of the pest are evident in the amount of damage found in some of the experimental blocks, where the infestation amounted to from 14 to 23 per cent. of the crop. In that orchard the variety most heavily infested was Belle of Georgia.

[1] Journal of Economic Entomology, Vol. 16, page 312.

Observations on the life history of the insect were made during the summer and though necessarily incomplete, some of the results are given herewith.

June 9—No sign of the Oriental peach moth at Greenwich or New Haven.
June 23—A few tips infested at Greenwich, the larvae one-half or two-thirds grown.
June 25—First infested tip seen at New Haven.
June 30—Most of larvae have left twigs at Greenwich; signs of one having entered a peach—doubtful.
July 3—Pupae obtained from June 23 material.
July 9—Four adults emerged from June 23 material.
July 10—Three adults emerged from June 23 material.
July 14—Many young larvae observed in tips at Greenwich—one in peach.
July 21—One adult emerged from July 23 material.
July 25—One egg found on tree at New Haven.
July 28—Many larvae observed in young orchard at Greenwich.
Aug. 3—Eight adults emerged from July 14 material.
Aug. 5—One adult emerged from July 14 material.
Aug. 7—Three adults emerged from July 14 material.
Aug. 8—One adult emerged from July 14 material.
Aug. 11—Four adults emerged from July 14 material.
Aug. 12—Two adults emerged from July 14 material.
Aug. 13—Twelve adults emerged from July 28 material.
Aug. 14—Four adults emerged from larvae obtained July 28.
Aug. 14—One adult emerged from larvae obtained July 14.
Aug. 15—Collected many small larvae in tips of young trees.
Aug. 15—Hale thinnings gave a total of 1 per cent. infested.
Aug. 25—Two adults emerged from July 28 material.
Aug. 28—Two adults emerged from July 28 material.
Sept. 1—One adult emerged on this date.
Sept. 9—One adult emerged on this date.

Grouping the adult emergence (from larvae collected June 23, July 14 and 28; August 15 and 22 and September 13, 25, 29 and October 1), we obtain the following results:

July	1–9	0 Adults
July	9–21	8
July	21–Aug. 1	0
Aug.	1–7	12
Aug.	7–14	24
Aug.	14–21	15
Aug.	21–Sept. 1	14
Sept.	1–9	2
Sept.	9–31	0

All larvae spinning after August 25 hibernated and did not pupate. Larvae were abundant in fruit from September 13 till October 2, but none of the larvae obtained at this time pupated.

We estimate the presence of at least three broods in Connecticut, but it is evident that adults of the insect did not reach the maximum period of abundance in 1924 until August and that the larvae were most abundant from August 15 until the last of September. From this it is apparent that some of the control

measures must be used towards the latter part of the season if the insect is to be controlled effectively.

A general summary of the habits of the Oriental peach moth has already been given[1] and it is advisable to mention here only such features as bear directly on its control, or affect its economic status. The eggs are laid on the underside of the peach foliage and sprays must be made to cover the leaves thoroughly if control is to be secured. The very short length of the egg stage naturally necessitates frequent nicotine or other egg sprays and at least one a week would appear to be necessary from this standpoint alone.

The young larvae soon after hatching may be killed with arsenicals[2] but the older larvae are not easily killed as has been repeatedly demonstrated. Thus we find arsenical applications of little use in mid-summer when the larvae are migrating from twigs to fruit, but later in the season when many go directly into the fruit, such applications may possibly be more effective.

The larvae frequently spin on the ground or near the ground on the trunk and clean cultivation together with such controls as the use of paradichlorobenzene, winter strength lime-sulphur and the like should be of help. The silken cocoon of the larva is water proof and it is not known exactly how sprays of the sort mentioned affect the larvae. Owing to the fact that many of the drop fruits which fall shortly before harvest time contain larvae, it would seem advisable to remove this fruit from the orchard and destroy it as soon as possible because it furnishes material for reinfestation.

Larvae entering peaches some time before ripening usually leave conspicuous evidence of the infestation due to the fact that gum is rapidly thrown out by the growing peach. Early fruit, too, is often infested by larvae migrating from the twigs. As a result there is usually little difficulty in grading out early infested peaches. Larvae which enter the fruit, however, when the latter begins to ripen (owing to the fact that little gum is thrown out and to the fact that many very minute larvae enter direct from the egg) cause much infested fruit which cannot be detected. Many of the larvae enter at the stem end and as shown in the illustrations (See Plate XXVII, a), leave only a very insignificant trace at the point of entrance. Still others enter through the side of the fruit and the frass thrown out at the point of entrance may be washed off or rubbed off in handling which results in a fruit wholly without external signs of infestation. Such fruit cannot be graded out and some of it naturally finds its way to the consumer as well as being shipped into districts where the Oriental peach moth is not yet established; sometimes with unfortunate results.

[1] Britton, W. E., Conn. Agr. Exp. Sta., Bull. 256: 284–287; 1923.
[2] Peterson, Alvah, Journal of Economic Entomology, 13: 391–398; 1920.

We have been much surprised at the amount of fruit infested in some orchards in 1924, especially when the amount of twig injury was relatively small as will be seen in Table 4. Such an increase may be due to the normal increase of the pest but there are also other possibilities—namely that of the shipment of wormy fruit from other infested sections and the consequent increase of the insect in the particular district concerned. Possibly there is also a natural flight of the moths in late summer similar to the case of the cotton moth and apparently so with the corn ear worm.

The adults are active about sundown, but have been seen near midday by some workers[1]. There is some possibility that adults may be killed by nicotine or other dusts; but not much is known of this phase of the problem.

In general the history of the Oriental peach moth thus far has been that it appears in destructive numbers for a few years, and then becomes relatively scarce. This has apparently been the case in Maryland and Virginia, due without doubt to the beneficial action of parasites. How often these waves of injuriousness will occur remains to be seen, and what will happen next year in Connecticut is only a guess but it will probably increase in intensity in sections hitherto not greatly affected, and decrease in sections where the greatest amount of damage was done in 1924.

Control Experiments.

The only field control experiments were conducted at Conyers Farm and were made possible through the kindness of Messrs. G. A. Drew and H. B. Reed, who granted the use of the treated blocks and furnished the labor for spraying and other operations. Four plots were used each consisting of six rows containing 54 to 61 trees. Nearly all were bearing, well cared for, and fertilized so that good growth resulted and a good crop of fruit was harvested, amounting in many cases to 10 to 15 baskets per tree.

The ingredients of the sprays and dusts used are as follows:

(1) Nicotine sulphate, ½ pint to 50 gallons.
(2) Lead arsenate, 1 pound to 50 gallons.
(3) Self-boiled lime-sulphur, 8-8-50 formula.
(4) P. & G. Naphtha soap, 2 pounds to 50 gallons.
(5) Casein lime spreader, ½ pound to 50 gallons in sprays containing lead arsenate and self-boiled lime-sulphur.
(6) 90–10 sulphur-arsenate dust.
(7) Commercial nicotine dust, guaranteed 2.7 per cent. nicotine.

The following applications were made on the four different blocks:

[1] Guyton, T. L., Journal of Economic Entomology, 17: 415; 1924.

(1) Fungicide only—self-boiled lime-sulphur, June 9 and July 14.
(2) Self-boiled lime-sulphur plus lead arsenate, plus nicotine sulphate, plus casein lime, June 9 and July 14; nicotine sulphate plus soap, June 30, July 28 and August 15.
(3) Self-boiled lime-sulphur plus lead arsenate, June 9 and July 14.
(4) Sulphur arsenate dust followed by nicotine dust, June 9 and July 14; nicotine dust, June 30, July 15 and August 2.

Counts were made of all drop fruits from 10 selected trees in the center of each block and of all fruit from five selected trees in each block, the scoring being done by exterior examination, grading into infested and uninfested lots. A number of each of these lots were then cut open and the correction for infested peaches overlooked in the first grading, applied to those figures. The results are seen in Table 3.

No conclusions will be drawn from these experiments until checked by similar tests, but they are presented here in order to show what was obtained in the way of control measures in 1924.

ORIENTAL PEACH MOTH CONTROL—1924.

TABLE 1—PICKED FRUIT FROM FIVE SELECTED TREES.

Block No.	Treatment	Good	Infested	Per Cent. Infested
1	Fungicide only, 2 sprays	3,237	393	10.8
2	5 sprays containing nicotine sulphate 2 with lead arsenate	2,528	190	6.9
3	Fungicide plus lead arsenate	3,539	408	10.3
4	5 dusts containing nicotine, 2 with arsenate	1,847	63	3.2

TABLE 2—ALL FRUIT FROM FIVE SELECTED TREES.

1	.....	4,040	655	13.9
2	.....	3,518	301	7.8
3	.....	4,036	556	12.1
4	.....	3,867	250	6.0

TABLE 3—CORRECTED FIGURES FROM TABLE 1 BASED ON CUT FRUIT.

1	.....	2,786	844	23.
2	.....	2,167	351	14.
4	.....	1,692	218	11.

TABLE 4—TWIG COUNTS OF ALL TREES MADE JULY 28, 1924.

Block No.	Treatment	No. Trees in Block	Total No. Injured Twigs	No. Injured Twigs per Tree
1	.....	54	318	5.8
2	.....	61	177	2.9
3	.....	56	192	3.4
4	.....	56	178	3.1

EFFECT OF VARIOUS INSECTICIDES ON THE EGGS OF THE EUROPEAN RED MITE (P. pilosus C. & F.)

PHILIP GARMAN.

Since the publication of Bulletin 252, on the European red mite, a number of tests have been made of the killing power of certain insecticides on the winter eggs. These tests are laboratory tests and results are comparable to what was obtained in previous experiments. For convenience, two proprietary oils now on the market have been compared and the results are shown in Table 2. Results in this table are a total of all tests made to date, including those reported in Bulletin 252.

TABLE 1.

Materials Used	Total No. of Eggs	Hatched	
		Number	Per Cent.
1. Niagara dormant dust	119	19	15.9
2. Soluble sulphur 1 oz. in 1 quart	115	29	25.2
3. " " " " "	198	32	16.1
4. " " " " "	478	98	20.5
5. " " " " "	230	99	43.0
6. " " " " "	201	49	24.3
7. Sunoco spray oil 1–15	231	1	.4
8. " " " 1–15	323	12	3.7
9. " " " 1–15	548	3	.5
10. " " " 1–20	227	1	.4
11. Carboleine 1–15	282	3	1.0
12. " 1–20	332	2	.6
13. Volcks 3%	467	2	.4
14. " 6%	469	9	1.9
15. Sherwin Williams Free Mulsion 1–15	202	4	1.9
16. Check—no treatment	483	225	46.5

Note. Tests 2-5 were made with fresh soluble sulphur of good yellow color; No. 6 with the same material after standing a year.

TABLE 2.

Materials Used	Total No. of Eggs	Hatched	
		Number	Per Cent.
1. Scalecide 1–15	4,853	238	4.9
2. " 1–20	182	0	0.0
3. " 1–25	1,258	68	5.4
4. " 1–50	968	66	6.8
5. Sunoco 1–15	1,055	18	1.7
6. " 1–20	227	1	.4
7. " 1–25	180	6	3.3
8. " 1–50	325	56	17.2

The percentage of hatch in the two lots should not necessarily be taken to indicate superiority of either oil, since the experimental error and variation is considerable. The experiments, however, indicate consistently that a dilution of 1 to 20 or 1 to 25 does not greatly reduce the toxicity of miscible oils of this type. As indicated in Table 1, soluble sulphur compounds do not give

as high a mortality in laboratory tests, although they have in common with oils, the property of covering all parts of the twig and "crawling" into spots not actually reached by the spray.

Some criticism of Table 14, Bulletin 252, has been received from manufacturers. Owing to omission of results in Table 11 from the final summary, Sunoco Spraying Oil was placed at the bottom of the list. Revised from the data as summarized in Table 14 from previous records in Bulletin 252, the last five items should read.

Exp. No.	Treatment	Hatched Per Cent.	Possible Kill Per Cent.	Number Eggs Used
10	Wormol	9.2	83.4	711
11	Scalecide	6.8	87.3	8,154
12	Sunoco Spray Oil	4.3	92.1	1,573
13	2% Red Engine Oil Emulsion	3.3	93.8	968
14	Jarvis Compound	.6	99.0	896

The original idea of this table was not to indicate superiority of any particular product especially where percentages are close, since the conditions of experiment varied, but was intended to show the increased kill in the case of certain types of miscible oils over other ovicides, namely lime-sulphur compounds or substitutes. However, in view of the possible harm done to certain manufacturers of spray materials we take pleasure in revising the latter part of this table and presenting it in corrected form. The figures represent a summary of all tests made with different dilutions and obviously should not be used as a direct comparison of different products.

THE ALCOHOL-FORMALIN SOLUTION FOR CONTROL OF AMERICAN FOUL BROOD.

PHILIP GARMAN.

Dr. J. C. Hutzelman was the first to demonstrate that combs containing American foul brood may be successfully sterilized with a mixture of formalin and alcohol. For this purpose he used[1] a solution of 20 per cent. formalin in alcohol, soaking the combs 48 hours after extracting all honey. He reports the successful sterilization of many combs. These facts together with the recommendation of this treatment by one of the largest manufacturers of bee supplies makes it advisable to explain the methods more fully, examining the constituents of the solution in detail in order to know what may be expected of it.

The procedure in general[4] is as follows.—Infected hives are removed to a "hospital yard" away from the main apiary, the bees shaken, hives disinfected and the combs treated according to the following method. The cells are uncapped, honey extracted and the combs are then placed in warm water which is later thrown

[1] See references at the end of this article.

out in the extractor. This treatment is necessary in order to remove all traces of honey which might remain in the combs and interfere with the disinfection. The combs are then placed in the alcohol-formalin solution and allowed to remain 48 hours after which the formalin solution is extracted and the combs allowed to dry. After these operations are complete, the bees are given a new queen and returned to the disinfected hive and combs.

Some workers state that it is not necessary to uncap all cells before immersion in the solution, but the advisability or inadvisability of this method has not been fully demonstrated. Knowing, however, the nature of the disease, that is, its bacterial origin, and the difficulty in getting rid of such diseases, it seems necessary to omit no precautions and to exercise the greatest care in treating the combs, It is known, moreover, that spores of American foul brood may remain without germination for many years and the inadvisability of basing conclusions on one season's work seems undesirable, unless of course the disease reappears within that time.

The minimum amount of the solution required is not less than five gallons and for practical purposes not less than 10 gallons should be purchased. For larger amounts special tanks should be constructed and special equipment obtained[4]. The material may be used repeatedly according to the manufacturer's recommendations.

Alcohol-formalin solution is very irritating and troublesome to handle. The fumes given off are stifling especially if confined to a closed room. We therefore recommend that it be handled in the open or in a place where there is plenty of ventilation. If the contents of each comb after soaking in the solution, are shaken back into the treating tank, fumes will be produced which will cause much discomfort to the operator. It is best to place the combs in the extractor direct, cover same and extract under cover; and it is especially desirable to handle the combs being treated with rubber gloves or some tool which will prevent the solution from coming into contact with the hands.

Formaldehyde gas dissolved in water is known commercially as formalin, and contains about 40 per cent. formaldehyde gas. Information about the process of manufacture reveals that formaldehyde is made from methyl or wood alcohol and the solution usually contains some of this chemical as a stabilizer. In nearly all formalin solutions obtained on the market there is also some paraformaldehyde, a white insoluble substance derived from formaldehyde. If this substance remains in the combs they will smell of formaldehyde long after the combs have been dried. The best way to remove paraformaldehyde should enough remain to be noticeable, is apparently by the use of sodium sulphite*

*A chemical used in photography costing about 25 cents a pound.

solution. Combs containing a large amount of paraformaldehyde were successfully treated at the Experiment Station by soaking after drying in a solution of this material containing 1 pound in 8 gallons of water.

The question very naturally arises whether it will pay the average small beekeeper to disinfect with alcohol-formalin solution. The minimum amount of the solution which may be used is about 10 gallons. At present prices this will cost about $15.00. It will follow that should the value of the stock or combs infected rise greatly above this initial cost, it would be to the advantage of the person interested to make use of the solution: otherwise it would seem better economy to destroy completely the infected bees and equipment. For the larger beekeeper who is liable to encounter the disease year after year, it should be of more value. Reports from other states seem to be favorable, but the opinion of Connecticut beekeepers is not definitely formed regarding the economic value of the treatment and several years will probably elapse before we shall know whether it will receive the endorsement or condemnation of beekeepers in general.

So far our experiments have not demonstrated conclusively whether the solution will or will not control American foul brood. Work along this line is to be continued.

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THE EGG OF THE BLUEBERRY SPITTLE-BUG,

Clastoptera proteus Fitch.

Philip Garman.

Eggs of this species were obtained in 1924 from bugs kept in confinement on growing plants. A search during the winter brought to light many old egg punctures and some live eggs in a similar position on wild bushes. Since the eggs of the species have not been recorded it seems advisable to describe their general form and location.

The eggs of *Clastoptera proteus* are similar to that of the alder bug *C. obtusa* and are laid beneath the bark on the outer twigs. They are sometimes thrust directly into the plant parallel to the axis of the stem and sometimes diagonally. Not more than three have been observed in a single puncture though only one may sometimes be found in each. Some of the characteristic punctures are shown on Plate XXX, f.

Total length .7 mm. greatest width .35 mm.; rounded at one end and tapering to a rather definite point at the other.

The eggs of six species representing four of the five genera of spittle-bugs occurring in this section are now known; leaving only the egg laying habits of *Aphrophora* species yet to be discovered. In general it may be stated that those eggs known so far are similar in form, being pointed at one end and rounded at the other, the only great differences being those of size. All are placed on the plants themselves, being either thrust into dead stems, into the sheath of the growing plant or just beneath the bark on new growth. The function of the rather stout ovipositors of members of the group therefore is plainly evident.

A list of references relating to the eggs and egg laying habits is given herewith.

Philaenus lineatus (Linnaeus), Barber, G. W. and Ellis W. O., Psyche, 29: 3: 1922. Garman P., Conn. Agr. Exp. Station, Bull. 230; p. 328: 1921.

Philaenus leucophthalmus (Linnaeus), Barber, G. W. and Ellis W. O., Psyche, 29: 3: 1922.

Clastoptera obtusa (Say) Garman, P., Ann. Ent. Soc. Amer., 16: 155: 1923.

Lepyronia quadrangularis (Say) Garman, P., Ann. Ent. Soc. Amer., 16: 160: 1925. Doering, Kathleen. Kans. Univ. Science Bull., 14: 536: 1922.

Philaronia bilineata (Say). Barber, G. W. and Ellis W. O., Psyche, 29: 3: 1922.

THE WOOLLY APHID OF APPLE AND ELM.

Eriosoma lanigerum Hausman.

The apple tree woolly aphid is said to occur throughout the world wherever the apple is grown. In England it is called the "American blight" and in Germany the "Blutlaus." It is a bark feeding aphid with two forms; one on the roots and the other on the twigs and branches. It is generally noticeable above ground, on account of the bluish-white patches on the twigs, shown on Plate XXIX, c with reddish-brown aphids close to the bark. The whitish color is due to many minute filaments of wax secreted and protruded by small pores in the epidermal coverings of the bodies of the aphids. These aphids often cluster in wounds such as scars, cankers or where branches have been cut off, and prevent their healing. In some cases, galls are formed on the twigs by the clusters of woolly aphids, and these galls together with the

whitish wax adhering around the margins of wounds are an indication of the presence of the pest. Several years ago, a seedling apple came up in a protected place just south of one of the Station buildings, where it was allowed to grow for several years. Each summer nearly every branch bore one or more of the bluish white patches, each patch being a colony of woolly aphids. Later the little tree was literally covered with swellings or galls on the twigs and branches as the result of the infestation, and the tree was finally removed to make room for needed improvements.

On the roots, galls are nearly always formed by this insect, and where this infestation is heavy, the root system may be only a mass of galls. These galls decay, often ruining the root system of the tree. I well remember some 12 years ago, a man in Groton purchased several hundred apple trees from a Tennessee nursery, and when they arrived, many of the trees had lost all of the smaller roots by decay following woolly aphid infestation. Some of the old stump roots were photographed and are shown on Plate XXIX, b. Most of the trees had galls on the roots but many of them had decayed and were worthless for planting. I was asked to make a statement and issue a certificate regarding the condition of this stock, to be used by the purchaser in making adjustment with the nurseryman. I also wrote to the nurseryman and to the official in charge of nursery inspection in Tennessee, and hope that such stock will not again be shipped into Connecticut. The root form also produces the white wax filaments but these are shorter and less conspicuous than is the case with the aerial form.

The woolly aphid is a much more serious pest further south than in Connecticut, but no doubt it causes some damage here. Nursery trees and young orchard trees are more seriously injured than larger and older orchard trees. The Northern Spy and some other varieties are said to be more or less exempt from attack. In examining apple twigs in the spring of 1924, evidences of the presence of woolly aphid were found in every one of 18 orchards submitting twigs, covering all parts of the State except New London and Windham Counties. Though perhaps the woolly aphid is not a major pest in Connecticut, some attention should be paid to it particularly in nurseries, and in newly established orchards. We believe that it will not seriously injure trees in Connecticut after they have become well established and have reached bearing size.

Gillette and Taylor state that "If Colorado orchardists should vote their opinion as to what ought to be called the worst orchard pest in the State, it is very doubtful whether the codling moth or the woolly aphis would carry off the honors."[1]

Life History.

The winter eggs are laid in the crevices of the bark on elm trees probably in September, and hatch in early spring. The aphids hatching from these eggs are wingless females, called stem mothers, which feed upon the expanding leaves and become mature late in May and cause the leaves to curl or form rosettes. Their young are also wingless and are born alive like the other summer generations of most aphids. The next generation, however, have wings and are known as spring migrants; they mature the latter part of June and migrate to apple trees. Sometimes they go to pear, quince, hawthorn or mountain ash. There are three summer generations in Maine[3] and in August winged females appear and shortly afterward lay the winter eggs.

According to Slingerland and Crosby, the development of the root form is quite similar to that of the form on the twigs and branches, though perhaps not fully worked out; also that "many of these wingless agamic nymphs persist on the roots, and some of them even on the tree above ground, all the year through even in New York State and other cold northern latitudes."[4]

Control Measures.

In general, orchardists should be advised not to plant trees with many galls on the roots. Nursery trees which have been seriously injured by the woolly aphid should be destroyed. Those which are not injured but which show evidences of infestation should before planting be either fumigated with hydrocyanic acid gas, or treated by dipping the roots in a nicotine solution containing a spreader, or in kerosene emulsion containing 15 per cent. kerosene. Hot water (130°-150° F.) is also recommended. Lime-sulphur, however, should not be used, as it may cause injury to the small roots.

In Missouri in 1896, experiments were rather successful in treating ten year old trees in the orchard by removing four inches of the top soil around each tree for a distance of two feet from the trunk and scattering evenly over this area four or six pounds of tobacco dust, then replacing the soil. With nursery trees, the dust was placed in trenches close beside the rows. In Georgia[5] more than ten years later, similar and more detailed experiments with various forms of tobacco in excavated areas and trenches gave very unsatisfactory results, but by removing three inches of the surface soil extending from one and one-half to four feet from the trunks, depending upon the size, and treating with 15 per cent. kerosene emulsion, good results were obtained. From three gallons of this emulsion on the smaller areas, to six gallons on the larger, saturated the soil to a depth of from two to four inches, and it gradually permeated the soil to a depth of a foot or more and the odor lasted for many weeks.

During the seasons of 1914 and 1915, Mr. B. R. Leach of the

Bureau of Entomology, conducted experiments against the woolly aphis in Virginia using various materials including kerosene emulsion, sodium cyanide, and carbon disulphide emulsion. His best results were obtained with carbon disulphide emulsion at the rate of one-half pound in four gallons of water, thoroughly agitated. A shallow basin was made around the tree and three-fourths of a gallon of the emulsion per square foot of soil was applied in the basin. He found this method quite satisfactory on small trees, where the conditions are favorable. The applications can be made at any time during the summer months, but are successful only when the soil is moist. Since Mr. Leach carried on these experiments, a soap emulsion of carbon disulphide has been manufactured and is now sold on the market. It is also possible to make at home a fairly good emulsion, and it is believed that these soap emulsions would also be effective in killing the root forms of woolly aphis, particularly after the proper proportions have been determined. Such emulsions have been used in this Department to kill the grubs of the Asiatic beetle, and did not injure the grass.

The aerial form of the woolly aphid can readily be killed by spraying with kerosene emulsion, or with nicotine sulphate and soap.

Literature.

The economic literature of this species is very voluminous, and only a few references are given here.

[1] Gillette, C. P., and Taylor, E. P., Bulletin 133, Colorado Agricultural Experiment Station, page 5, 1908.

[2] Leach, B. R., Bulletin 730, United States Department of Agriculture, pages 29-40, 1918.

[3] Patch, Edith M., Bulletin 256, Maine Agricultural Experiment Station, 1916.

[4] Slingerland, M. V., and Crosby, C. R., Manual of Fruit Insects, page 156, 1914.

[5] Smith, R. I., Bulletin 23, Georgia State Board of Entomology, 1907.

[6] Stedman, J. M., Bulletin 35, Missouri Agricultural Experiment Station, 1896.

THE LIME TREE WINTER MOTH.

Erannis tiliaria Harris.

This native American insect occurs throughout the eastern United States and Canada, westward to the Rocky Mountains. The larvae feed upon the foliage of apple, pear, linden, birch, elm, oak and hickory and probably other forest trees. As a rule it is not very abundant in Connecticut and therefore little attention has been paid to it. Occasionally it becomes so abundant as to cause damage by defoliating trees, and such may be the case in Connecticut in 1925, as the male moths were very abundant in October and November, flying around electric lights in cities and villages. Not only were the moths noticeable in Connecticut, but were reported as being abundant throughout Massa-

chusetts and portions of New York State. On November 1, a specimen of the male was received from Sharon with a statement that it was very abundant there, and since then I have learned that the caterpillars of this insect in the summer of 1924 caused noticeable damage to the beautiful elm trees on the village green. Hence, all persons responsible for the care of valued shade trees, whether on public or private grounds, should be warned to look out for the depredations of this insect early in the coming summer.

Other common names of the caterpillars are: lime tree span worm, lime inch worm and ten-lined inch worm.

Injury.

The injury consists in the caterpillars feeding upon the leaves during the month of May. This may well be ascribed to canker worms as it has a similar appearance and occurs at about the same time. In fact the larvae or caterpillars are often found feeding with canker worms, but as they are larger and have a more distinctly yellowish color on the lower portion of the sides and on the under surface, they can readily be distinguished from them. In 1912, this insect appeared in large numbers in western New York, and riddled the foliage of apple and cherry trees along the roadsides and to some extent in commercial orchards. Linden and elm trees were also partially defoliated.[3] In 1914, an outbreak of this insect was reported from Ulster County, N. Y., and orchard and woodland trees were attacked.[2]

At first the caterpillars eat elongated holes, but when they are abundant they completely riddle the leaves.

Habits and Life History.

Like the canker worms, this insect has one generation annually, the females are wingless, the caterpillars feed upon the leaves at the same time of the year and loop in crawling. The eggs hatch in April or early in May and the caterpillars become fully-grown early in June and transform to the pupa stage in cells in the ground. Some may pupate in May and usually all have pupated by the middle of June. The caterpillars have the habit of remaining rigid in one position or feigning death, sometimes fastened only at one end and the other standing out in a straight line like a twig. In Connecticut the adults for the most part emerge in the fall, though according to Dr. Saunders, in Canada fall emergence is rare and most of them emerge in spring.

One of the best biological accounts of this insect published in recent years is by Professor W. J. Schoene, in Bulletin 421, of the New York (Geneva) Agricultural Experiment Station, page 376, Plates V and VI, May, 1916, and the present writer has drawn upon it freely. Professor Schoene records no observations on the hatching of the eggs, but states that the females in a cool

room continued to oviposit for a week, scattering their eggs over the bark, some in cracks, some under the edges and some on exposed situations; also that 533 eggs were taken from the abdomen of one female.

On October 15, 1924, the males were quite abundant around electric lights, and several were collected. They did not disappear at once but were seen on warm nights through the remainder of October and November. Mr. Rogers spent some time looking over trees but did not find any females. The writer collected three females from the trunks of woodland trees, November 20, in Macedonia State Park, Kent.

The Station collection contains males collected by the writer in New Haven, 25 November, 1905; 7 November, 1906; 15 October, 1924. Two specimens from Pemaquid Point, Me., collected in August, 1906, by Professor H. W. Foote are also in our collection.

Descriptions.

Egg: Cream color, shape somewhat cylindrical, bluntly rounded at the ends. The sides and one end where the cap is situated are marked with compressed hexagonal reticulations, most pronounced on the cap. Laid singly or sometimes in loose clusters generally attached by one side. Length about .9 mm., width about .52 mm. The eggs are shown on Plate XXX, c.

Larva: A bright yellow looping caterpillar with rust-brown head and ten crinkled black lines extending longitudinally along the back. There is great variation in width of these lines, so that the dorsal view of some caterpillars is nearly black, and others are distinctly light-colored. The outer black line or stripe is often heavier or more pronounced than the others and is wavy, giving a scalloped appearance to the margin. The under surface is yellow and paler than the yellow between the black lines. Legs and prolegs yellow. Length of mature larva, nearly 1.5 inches. See Plate XXX, d.

Pupa: The pupae are brown, slightly more than half an inch in length and rather stout, though the females are somewhat shorter and thicker than the males. The pupae of both sexes terminate in a sharp point.

Adults: Male, forewings buff, marked transversely with two wavy brown bands, and sprinkled with fine brownish dots; rear wings, lighter buff or nearly white with no prominent markings. Scales of head, thorax, abdomen, and legs and antennae about the same tint as ground color of forewings. Wing-expanse about 1.75 inches.

Female, wingless, greenish-yellow, varying to light gray or brown, with two rows of black spots on the back. Legs and antennae are ringed with black and yellow or the ground color. Length about half an inch.

Both sexes are shown on Plate XXX, a and b.

Methods of Control.

The best means of control is to spray the foliage in May with lead arsenate as is done for canker worms. The poison may be applied as soon as there is sufficient foliage to hold the poison. If applied too early, other leaves will put out upon which the caterpillar may feed and two sprayings may be required. If applied too late, considerably injury will result before the caterpillars are killed. In the average season, about the middle of May will probably be the best time. From three to five pounds of powdered lead arsenate per 100 gallons of water may be used, and if one pound of caseinate spreader is added, it will be possible to give a better coating to the foliage.

Literature.

[1] Britton, W. E., Report Conn. Agr. Expt. Station, page 184, 1915.
[2] Felt, E. P., 30th Report, New York State Entomologist, page 59, 1914.
[3] Schoene, W. J., New York (Geneva) Agr. Expt. Station, Bull. 423, page 376, 1916.
[4] Slingerland, M. V., and Crosby, C. R., Manual of Fruit Insects, page 89, 1914.

SUBSTANCES ATTRACTIVE TO THE CABBAGE MAGGOT FLY.

R. B. Friend.

The experiment described below was carried on at the Experiment Station Farm, Mount Carmel, in the spring of 1924 for the purpose of finding some substance which would attract adult females of the cabbage maggot (*Hylemyia brassicae* Bouché) before oviposition occurred. This fly lays its eggs just below the surface of the ground close to the stem of the young cabbage plant. Believing that the odor of the cabbage plant would be attractive to the flies, especially if combined with some sweet substance, materials were tried which contained extracts of the cabbage plant or pieces of the plant itself. In view of results obtained by the New Jersey Station with a honey and yeast mixture in attracting the adults of *H. ceparum,* this medium was used extensively in our experiments. The following mixtures were tried over periods of varying length, the number of trials depending on the promise shown by the bait.

1. Residue from distilled extract, honey, yeast and water.
2. Pieces of cabbage, honey, yeast and water.
3. Pieces of cabbage, molasses, yeast and water.
4. Brown sugar, yeast and water.
5. Extract of the cabbage plant.
6. Residue from distilled extract.
7. Extract of the cabbage plant and ground charcoal.
8. Honey, yeast and water.
9. Molasses, yeast and water.
10. Pieces of cabbage, brown sugar, yeast and water.

The extract of the cabbage plant was prepared by grinding the entire plant in a food grinder, adding to this an amount of 95 per cent. ethyl alcohol in cubic centimeters equal to the weight of the cabbage in grams (this amount was sufficient to cover the ground cabbage) and letting this mixture stand at room temperature a week. It was then filtered in a press, and the resulting clear alcoholic extract distilled under reduced pressure at bath temperature of 65°-75° C. to about one-twentieth of the original volume. Most of the odoriferous substance apparently remained in the residue. Any reference to extract refers to the filtered but not distilled alcoholic extract, and references to residue refer to the residue left after distilling the extract.

The material in each trial was placed in the pan of a Hodge fly trap and kept from drying by the addition of water. About five grams of honey, molasses or sugar was used with enough water for 60 cc. About 20 cc. of residue was used, and when yeast was used, a cube five millimeters thick was found sufficient. The extract was always used pure. If pieces of cabbage were used, five or six pieces of leaf about 2 cm. square were added. In the trials with charcoal, two teaspoons of ground charcoal were added. The traps were set on the ground and in the rows between plants, being about twenty feet apart. The cabbage plot contained three rows of plants and was about 200 feet long. Examination of traps was made each day, the flies killed and removed, and water was added if necessary. One of these traps is shown on Plate XXXI, a.

The experiment was carried on from May 20 to June 10, and Table I gives the results obtained. These figures are totals of five species of the genus *Hylemyia, H. brassicae* Bouché, *H. ceparum* Meigen, *H. cilicrura* Rondani, *H. cinerella* Fallen, and *H. trichodactyla* Rondani, of which *cinerella* and *ceparum* probably do not attack the Cruciferae. It will be noticed that between May 22 and May 27, when conditions were similar for all materials then tried, that the residue-honey-yeast-water formula proved by far the most attractive, and the cabbage-yeast-molasses-water formula was next, although the difference between the latter and the molasses-yeast-water formula was insignificant. If the table is examined carefully and the dates noted, it will be apparent that the residue-honey-yeast-water formula is far superior to any other tried. The addition of yeast in quantities sufficient to form a noticeable ferment was of distinct value, as without this the materials were much less attractive. Other baits tried but found of little value were mustard oil (allyl isothiocyanate), allyl alcohol, ethyl alcohol, methyl alcohol, isopropyl alcohol, butyl alcohol, honey, brown sugar, water, and yeast. These were used with water in all cases. The addition of charcoal removed the attractiveness. The residue in itself was by no means as attractive as when mixed with yeast and honey.

The durability of the attractiveness of the materials was observed, and Table II gives these figures. The residue-honey-yeast-water formula was by far the most durable and the pure extract the least. The volatility of the alcohol in the extract rendered it unattractive after a day. This was also true of the alcohols tried. In one instance the residue-honey-yeast formula remained attractive two weeks with the addition of water only. In Table II, the dates begin at May 16, as four traps were set on that date, although the main part of the experiment did not begin until May 20. As soon as any yeast bait became dry, the yeast died and had to be replaced. The need of sugar as food for yeast is obvious, and the sugars are, of course, attractive in themselves.

The total number of flies of all species caught was 1,841 females and 583 males, and the greatest number in any one day was 70 with the pure extract on May 23, and 61 with the residue-honey-yeast-water formula on May 27. An estimation based on a determination of 348 individuals taken at various times in the course of the experiment indicates that 68 per cent. of the females and 76 per cent. of the males were *H. cilicrura* and only five per cent. of the females and two per cent. of the males were *H. brassicae,* these two species being the ones with which we were most concerned. The relative extent to which these species attack cabbage is not known. A warm bright day gave more flies than a day that was cool or cloudy. The occurrence of rain gave little trouble with the baits, as the wire of the traps protected the pans and prevented an overflow. The traps were staked down to prevent the wind from turning them over. A change in the relative position of the traps indicated that this factor was negligible. The plot sloped but little and conditions were uniform in this respect. The great predominance of females over males might have been due in part to the odor of the cabbage plant, the females being attracted to this plant to oviposit. Several females were examined for eggs, and of those examined 75 per cent. contained eggs in varying stages of development, the number of eggs per female running up to 44. In a series of similar experiments with the onion maggot (*Hylemyia ceparum*) all the females were examined each day, and eggs were found in from 76 to 91 per cent. of the individuals. There is no doubt but what most of the flies caught were females, and of the females, the great majority had not finished ovipositing.

No check plot was used, so no definite idea of the effectiveness of the use of traps as a control measure could be obtained. On May 8, 570 plants were set out and on June 13, 569 were still growing. When a plant wilted, it was at once examined for maggots; in only one case were maggots the cause of the death of a plant. Several plants were retarded by other factors, including cutworms, and there is a possibility that some maggots

were present in numbers too small to kill or wilt the plant. On August 7, 163 plants were so retarded as to be useless. The cabbage maggot was not a serious pest around New Haven this season.

In experiments elsewhere, allyl isothiocyanate and allyl alcohol have proved attractive to *Hylemyia cilicrura* and *Hylemyia ceparum*, and further trials will be made with these materials with the cabbage maggot.

I am indebted to Dr. H. C. Huckett for assistance in determining the species of Anthomyiinae taken in the experiment.

TABLE I.

NUMBER OF FLIES CAUGHT AT MOUNT CARMEL, 1924.

Formulae	Total Female	Total Male	Average per trap Female	Average per trap Male	Average per trap May 22-27, inc. Female	Average per trap May 22-27, inc. Male	Average per trap May 20-June 3 inc. Female	Average per trap May 20-June 3 inc. Male
Honey-Yeast-Water-Cabbage	21 traps		21 traps		5 traps		18 traps	
May 20-June 5, inc	297	85	14.1	4	10.2	3.8	14.6	4.4
Honey-Yeast-Water-Residue	33 traps		33 traps		5 traps		18 traps	
May 20-June 10, inc.	466	118	14.1	3.6	32	8.6	17.5	4.7
Residue	27 traps		27 traps		8 traps		21 traps	
May 20-June 10, inc.	282	87	10.4	3.2	11	4.5	11.3	3.6
Extract	28 traps		28 traps		15 traps		28 traps	
May 20-June 3, inc.	337	129	12	4.6	14.7	5.7	12	4.6
Extract-Charcoal	7 traps		7 traps					
May 20-27, inc.	52	11	7.4	1.6				
Yeast-Honey-Water.	2 traps		2 traps					
May 22-23, inc.	17	6	8.5	3				
Yeast-Brown Sugar-Water	5 traps		5 traps		5 traps			
May 22-27, inc.	73	23	14.6	4.6	14.6	4.6		
Yeast-Molasses-Water	5 traps		5 traps		5 traps			
May 22-27, inc.	84	27	16.8	5.4	16.8	5.4		
Brown Sugar-Yeast-Water-Cabbage	5 traps		5 traps		5 traps			
May 22-27, inc.	44	18	8.8	3.6	8.8	3.6		
Molasses-Yeast-Water-Cabbage	5 traps		5 traps		5 traps			
May 22-27, inc.	86	22	17.2	4.4	17.2	4.4		

The number of traps is the total gained by considering one trap set one day as one, two traps in one day two, one trap for two days two, etc.

TABLE II.

DURABILITY OF ATTRACTIVENESS.

		May											June					
		16	17	18	19	20	21	22	23	24	25	27	30	1	3	5	7	10
Residue Honey Yeast Water	Female	15	10	7	13	5	11	11	29	23	36	61	16	10 — 20		5	32	1
	Male	6	2	2	5	7	6	8	12	3	9	11	1	0 — 4		1	2	1
	Female	..	..	..	..	3	13		discontinued				14	7	1	0 — 5		3
	Male	..	..	..	..	1	4	..	..	..	..	..	5	3	0	0 — 3		1
	Female	..	..	..	..	..	..	..	..	..	..	..	23	29	3	0 — 7		14
	Male	..	..	..	..	..	..	..	..	..	..	..	8	3	0	0 — 3		7
Cabbage Honey Yeast Water	Female	7	5	5	11	4	7 — 23		13	5	4	6 — 31		19	4	11	..	..
	Male	7	3	2	3	2	3 — 10		5	1	1	2 — 8		4	0	2	..	..
	Female	..	..	..	..	2	5		discontinued				33	18	4	10	..	..
	Male	..	..	..	..	2	10	..	..	..	..	..	3	1	1	3	..	..
	Female	..	..	..	..	..	..	..	..	..	..	..	41	37	6	14	..	..
	Male	..	..	..	..	..	..	..	..	..	..	..	6	21	0	0	..	..
Residue	Female	..	..	..	..	0	0 — 2		21	12	4	24 — 33		45	14	15 — 18		6
	Male	..	..	..	..	0	1 — 2		13	3	2	6 — 9		8	0	3 — 2		4
	Female	..	..	..	..	1	2	discontinued		1	7	17 — 4		12	0	1 — 2		2
	Male	..	..	..	..	0	0	..	..	0	1	9 — 3		2	0	2 — 0		0
	Female	..	..	..	..	..	..	..	..	..	..	..	22	13	4	..	..	..
	Male	..	..	..	..	..	..	..	..	..	..	..	10	7	0	..	..	..
Extract	Female	..	..	..	..	5	5 — 18		30	10	1	19 — 20 — 12 — 3				..	..	..
	Male	..	..	..	..	6	6 — 10		20	2	1	3 — 1 — 2 — 0				..	..	..
	Female	..	..	..	..	11	2 — 9		14	2	3	1	..	..	..	..	..	..
	Male	..	..	..	..	9	2 — 9		6	0	0	1	..	..	..	..	..	..
	Female	..	..	..	..	..	..	17	70	13	7	7 — 19 — 17 — 0				..	..	..
	Male	..	..	..	..	..	..	14	16	3	0	0 — 4 — 7 — 1				..	..	..
	Female	..	..	..	..	..	..	..	..	..	..	..	7 — 12 — 3			..	..	..
	Male	..	..	..	..	..	..	..	..	..	..	..	1 — 4 — 1			..	..	..

Each time the bait was renewed is indicated by a dash (—), except when water alone was added. Each line (male and female) gives results of one series with one trap.

EXPERIENCES IN DUSTING TO KILL PEA APHID, CABBAGE APHID, AND ONION THRIPS.

R. B. FRIEND AND B. H. WALDEN.

The following experiments were carried on to determine whether or not nicotine dust (commercial brands containing 2.75 per cent. nicotine and 3 per cent. nicotine) would kill the insects in question. In all these experiments a rotary hand duster was used. Some of the dusting was done at the Experiment Station Farm at Mount Carmel, and some was done at other farms in the State.

The cabbage aphis, *Brevicoryne brassicae* L., when infesting cabbages to any great degree, causes the leaves to curl and checks the growth to such an extent that solid heads do not form. At the farm of Mr. E. M. Wooding at North Haven, one application of 3 per cent. nicotine dust at the rate of 50 pounds per acre (applied by Mr. Wooding) practically eliminated the aphids. The dust was applied on a two-acre plot between 7:00 A.M. and 1.00 P.M., July 26, 1924. The infestation had progressed to the extent that some of the leaves had curled. Experiments at the Station Farm where the infestation was somewhat lighter showed a good control with 2.75 per cent. nicotine dust. Dusting should be done as soon as the aphids appear in small numbers on the plants and before the leaves are curled, when a lighter application than the above would probably give equally good results. If the leaves have curled, it will require more time to make the application, as the nozzle of the duster should be inserted into the curled leaves to reach the aphids thus protected. The best time for dusting seems to be in the late afternoon of a warm, quiet, clear day.

The pea aphis, *Illinoia pisi* Kalt., was only locally abundant around New Haven in 1924. A badly infested field of garden peas situated near the Station was treated with a very heavy application of 2.75 per cent. nicotine dust on June 25, 1924, at 10:00 A.M. The temperature was about 82° F., and the day clear. A rather strong south wind was blowing. The vines were well grown, the peas being almost ready to pick, and the infestation was very heavy. Dust was applied at the rate of about 140 pounds per acre, and a count of aphids was made the following day. This count was made from three random samples from the dusted area and three random similar samples from the undusted area. The dusted plants had 181 live aphids, against 1,663 on the checks, 89 per cent. being killed. As this application of dust was much heavier than would ordinarily be applied, recommendations as to control cannot be made from this experiment. Further work will be carried out along this line. In Maryland, experiments of Cory and Potts (Univ. of Maryland Agr. Expt. Sta., Bulletin 261, February, 1924) where large areas were dusted with power dusters, show that 5 per cent. dust at not less than 30 pounds per acre will give an economical control

when applied with the aid of a long trailer. For details, see their bulletin. The pea aphid and the hand duster in operation are shown on Plate XXXI, b and c.

The onion thrips is difficult to control because there are always many individuals down in the sheath of the leaf protected against the treatment. A heavy application of 2.75 per cent. nicotine dust was applied to Ebenezer onions (sets) at the farm of W. S. Morris & Company in Wethersfield on July 16, 1924. The dust was applied at 2:00 P.M. The day was fair and warm, and the wind fairly strong. A count of thrips from dusted and untreated areas showed little control, if any, with the dust. The onions were well grown (about 15 inches high), and the infestation of thrips heavy. On July 21, the above plot was again dusted, together with an additional untreated area. This application was at the rate of 200 pounds per acre and was applied at 3:00 P.M. The day was fair and warm, and a rather strong west wind was blowing. On July 24, random samples were taken from the untreated and treated areas. As field observations showed the dust killed the thrips which were on the exposed parts of the leaves, that is, not in the sheath; the plants examined were cut one inch above and one inch below the sheaths and thrips counted in this sheath area only. The plants from the check area (untreated) showed 551 thrips as against 291 for the area dusted once and 98 for the area dusted twice. However, the lowest count plant from the check area had fewer thrips than the highest count plant from the area dusted once. All the plants dusted twice had a small number of thrips in the sheath.

Plots of young onions (6 inches high) in the Station garden at New Haven were dusted under favorable conditions July 25 and July 28, 1924. Field observations indicated that there were many live thrips in the sheath of the leaves, although those on the exposed parts of the leaves were killed. Apparently 2.75 per cent. nicotine dust, even though in excessive quantities, will not fully control the onion thrips when applied with a hand duster as above. Further experiments will be conducted with nicotine dust on this insect.

In dusting vegetables for aphids, the dust should be applied late in the afternoon and if possible when there is no breeze blowing. The temperature should be high, above 70° F., for good results. Dusting should not be delayed until the infestation is severe enough to wilt or curl the leaves, as even a heavy application of dust will then give less satisfactory results than a light application put on when the insects are not very numerous. Higher concentrations of nicotine in the dust as a rule will give better results than lower concentrations, other things being equal, and less dust will be required.

From our observation with the majority of hand dusters, it is necessary to use a larger amount of dust to cover the plants thoroughly than is required with a power duster that drives the dust with greater force into every part of the plant.

HINTS ON PHOTOGRAPHING INSECTS[1]

B. H. WALDEN.

It is rather difficult to know just what will be of interest to this gathering regarding insect photography, as some of you have had considerable experience in photographic work while others may have no occasion to take pictures.

In general, photographing insects is somewhat similar to making portraits; it is necessary to arrange a miniature studio and follow the same principles in lighting, exposure, etc. So instead of strictly following the subject, I am planning to take up certain points regarding which there has been more or less inquiry by different ones who are interested in insect photography.

The question of lenses is one that has probably received more attention than any other. Many are puzzled to understand why

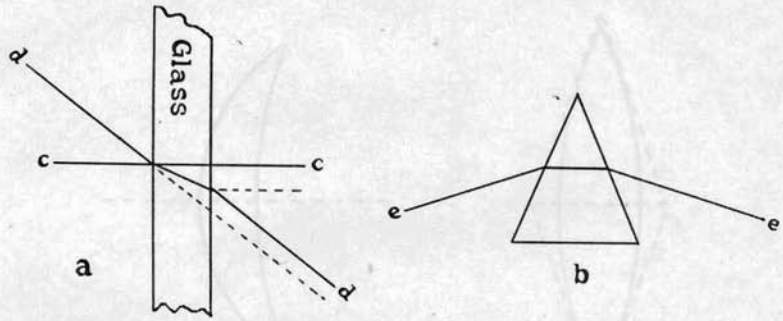


Figure 8. a. c. c. represents a ray of light passing from air through a plate of glass at right angles to its surface; d. d. a ray of light bent in passing from air through glass when entering the surface at an oblique angle. b. e. e. Showing the way that a ray of light is bent in passing through a prism.

a photograph taken with a cheap single lens may be apparently as good as one made with an expensive anastigmat lens. Frequently the dealer is not clear in explaining the limits of the different types of lenses, and often overrates the advantage of the anastigmat lens.

In order to point out the development of the photographic lens, it is necessary to consider some of the first principles in optics.

We see objects by the light that is reflected from their surfaces. The surface of the object can be considered as being made up of an infinite number of points, each of which is reflecting rays of light, and the function of the photographic lens is to gather as many as possible of these rays and transpose them onto the plate or film in such a manner as to form a reproduction of the object.

[1] Paper read before the meeting of Connecticut Entomologists, New Haven, October 31, 1924.

A ray of light travels in a straight line as long as it continues in the same medium, such as the air, and will continue in a straight line if it passes from the first medium into another medium of the same density. If the ray of light passes from one medium to another of different density, i. e., from air to a plate of glass, and enters the latter at right angles to its surface, it will still continue in a straight line (see Fig. 8a, c.c. = a ray of light entering at right angles), but if the ray of light enters the glass at an oblique angle, it is bent away from a straight line. Upon leaving the glass and again entering the air, the ray will be bent parallel to the direction to which it entered (see Fig. 8a, d.d.). The ray of light when entering a denser medium is bent toward the normal (represented by c.c. Fig. 8a.) and when passing from denser medium to a rarer one is bent away from the normal.

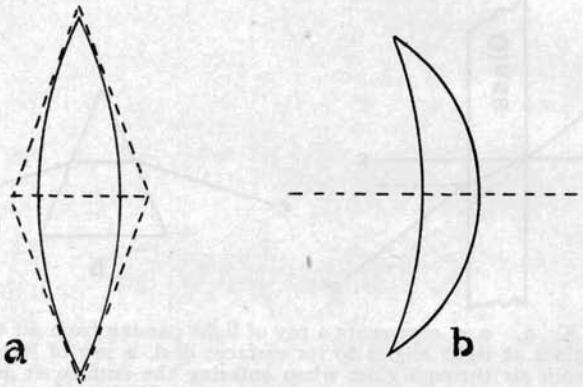


Figure 9. a. Showing the shape of a lens designed from prisms placed base to base; b. A meniscus lens, the simplest form of photographic lens, made from a single piece of glass.

This bending of light rays is called refraction and the degree of refraction depends upon the difference in density of the media and the angle at which the ray enters a different medium. According to the laws of refraction, if a ray of light is passed through a prism, the rays of light will be bent as shown at e.e. Fig 8b. If two prisms are placed base to base as shown in Fig. 9a. we have the principle upon which a simple lens is constructed, although the lines of the lens must be curved; every portion of the surface of a lens is a perfect arc of a circle. A lens of this form, however, is not suitable for photographic purposes. Fig. 9b. shows in cross-section the shape that the simplest photographic lens made from a single piece of glass must be constructed. This is known as the meniscus lens, so called from the crescent shape.

If such a lens is placed in a camera and an object is focused

on the ground glass and photographed, the negative will not be sharp. The reason for this is as follows. When light is passed through a prism, in addition to the bending of the rays as is shown in Fig. 8b., they are separated into the various colors of which the white light is composed. Each of the colors have a different wave length, red and yellow having the longest come at one end of the scale, and the violet and blue with the shortest wave lengths are at the other (Fig 10a.). Furthermore, the yellow rays are the "visual" rays or the ones by which we see the object on the ground glass, and the violet rays are the "chemical" rays or the ones which effect the sensitive film, so that when we focus such a meniscus lens, the ground glass will be in a plane of the yellow rays back of the plane of the violet and blue rays (see Fig. 10a, C. P. and V. P.

It is not possible to make a lens of a single piece of glass that will bring the yellow and violet rays into the same plane. This

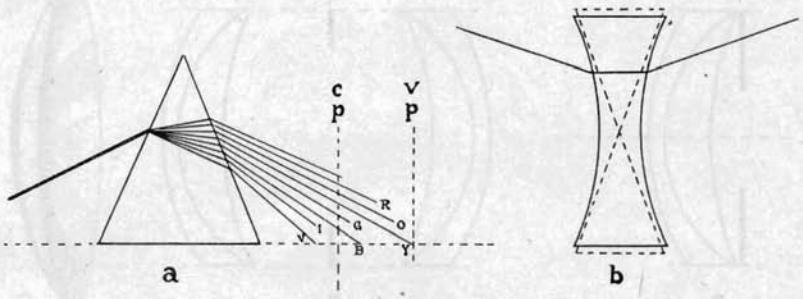


Figure 10. a. A ray of light separated by a prism into the principal colors of which it is composed; v. p., the visual plane and c. p., the chemical plane. b. A negative lens designed from two prisms placed tip to tip, showing the direction a ray of light is bent.

fault is known as chromatic aberration. These lenses are used, however, in some of the cheapest fixed focus box cameras by placing the lens so that the chemical rays will focus on the plate or film.

If a lens is designed from two prisms placed with the points together instead of the bases, the rays of light would be bent out or diverge instead of being bent in or converging as with the latter (Fig 10b.). The converging lens is also called a positive lens and the diverging lens a negative lens.

By using two kinds of glass of different density and combining a converging and diverging lens (Fig. 11a.), it is possible to bring the focus of many of the visual and chemical rays into the same plane. This type of lens is known as an achromatic meniscus. While this lens is a decided advance over the simple meniscus lens, it is not possible to control the rays of light at the edges

of the lens, so that it is necessary to cut out these rays with a stop, and use only those rays coming through the central portion. If we photograph an object with straight lines, such as a window, placing the stop behind the achromatic lens, the lines at the edges of the window in the photograph will curve outward (Fig. 12a.) If the stop is placed at the front of the lens, the edges will curve inward (Fig. 12b.) By combining two of these lenses with the concave surfaces toward each other and placing the stop between the two, this defect will be overcome and the lines will be straight in the photograph (Fig. 12c.) Such a lens is known as a rectilinear lens (Fig. 11b.) More of the marginal rays can be controlled in a rectilinear than in an achromatic lens, and a stop with a larger opening may be used, which admits between three and four times as much light as the single lens. The rectilinear lens, while satisfactory for many kinds of work,

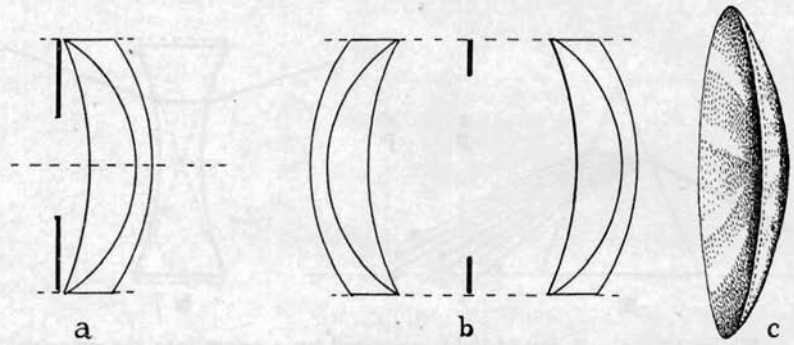


Figure 11. a. An achromatic lens, consisting of a positive and negative component; b. Construction of a rapid rectilinear lens; c. Diagram illustrating curvature of field of rectilinear lens.

still has many defects. The chromatic aberration is not entirely eliminated. If the image on the ground glass is focused sharply at the center, the edges of the field will not be sharp, showing that it is more or less saucer-shaped (Fig. 11c.). This is known as curvature of the field. In addition to this, some of the marginal rays cross those entering through the central portion of the lens and fall on the plate or film at an angle causing a slight blurring of the image. This defect common to the rectilinear lens, is spherical aberration and can only be corrected by using a smaller stop, eliminating the marginal rays and increasing the exposure. In photographing geometric figures or objects with both vertical and horizontal lines with a rectilinear lens, only one series of lines can be sharply focused, due to astigmatism.

Up to about 30 years ago, only two kinds of glass were available for making lenses: crown glass and flint glass. These were

of different density and therefore each would bend the rays at different angles. Positive lenses or elements were usually made of crown glass, and the negative elements of flint glass. Only a certain degree of skill was required to reduce the principal defects, curvature of the field, chromatic and spherical aberration and astigmatism to the limit obtainable with these glasses.

About this time, a new kind of glass was produced which could be made in different degrees of density, and lenses could be made in which the above mentioned defects could be practically eliminated. This is the Jena glass from which the anastigmat lenses are made. These lenses could be further corrected for certain other faults which are essential in certain critical lines, but of little importance to the ordinary workers.

In the anastigmat lens, it is also possible to bring the light rays entering near the margin of the lens into the same plane as

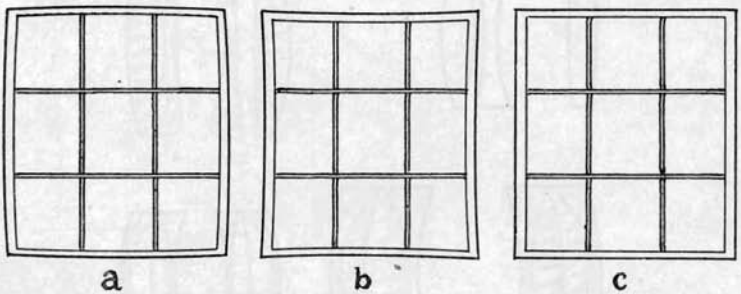


Figure 12. a. Diagram of a window sash showing distortion with the stop behind a meniscus lens; b. The same with the stop in front; c. Lack of distortion when made with a rectilinear lens.

those nearer the center, so that it is not necessary to "stop" them out. For this reason, from 40 to 300 per cent. more light, depending upon the construction, will pass through these lenses than through the rectilinear lens. While the anastigmat lens is comparatively free from optical faults, it is only by using great care in the construction that the defects found in other types of other lenses can be eliminated. The lens glass will vary in density with the amount of heat used in fusing it, and the lens formula must be computed for each lot of glass. The elements are ground and polished to within at least one thirty-thousandths of an inch. This grinding has to be done slowly so as not to heat the glass and cause it to expand. Anastigmat lenses may have from three to 10 glasses in their construction (see Fig. 13) and it is not hard to see why they may cost from five to 10 times as much as rectilinear lenses.

The size of a photographic lens is based on what is known as the focal length. This is approximately the distance from the

ground glass or film to the center of the lens, when it is focused on an object at a distance of 100 feet. Cameras for general work are usually fitted with a lens, the focal length of which is equal to, or slightly shorter, than the diagonal of their plates or films: for example, a $3\frac{1}{4}$ x $4\frac{1}{4}$ camera with a diagonal of 5.3 inches will have a lens of about $5\frac{1}{4}$ inches. Fig. 14 gives the diagonals and focal lengths of lenses for three common sizes of cameras. A lens of shorter focal length will give an exaggerated prospective; that is, nearby objects will appear too large and distant objects will be proportionately small. A lens of a focal length longer than the diagonal of the plate will often give a better prospective, but would be too large to fit the average small hand camera. It is also necessary in photographing large objects,

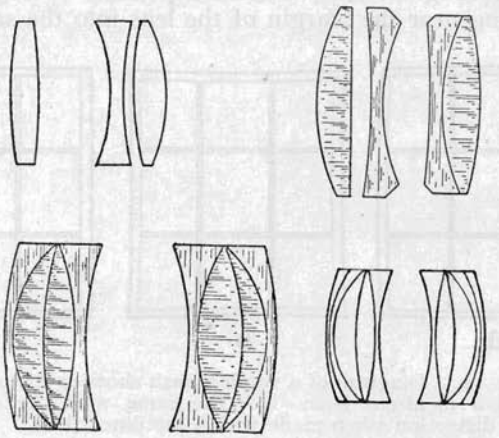


Figure 13. Diagrams of the construction of anastigmat lenses, with from three to ten glasses.

such as buildings, to stand further away to include as much in the view as is done with the shorter focus lens.

Lenses are provided with stops to cut down the size of the aperture. There are two systems in general use, both of which are based on the focal length of the lens. In what is known as the "f" system, the diameter of the opening is a fractional part of the focal length; that is, if the largest stop or opening of an eight inch lens is one inch in diameter (one-eighth of the focal length), it would be marked "f.8" which also indicates the speed of the lens and would be called an f.8 lens. The diameter of each of the smaller stops would be indicated by their fractional value as f.11 (one-eleventh), f.16 (one-sixteenth), etc.

In the other system, called the uniform system (U.S.), the equivalent of f.8 is designated as 4, and the number for each smaller stop is twice that of the preceding and indicates that the

exposure should be doubled. This system is generally used with rapid rectilinear lenses, while stops of anastigmats are usually marked with the f. system. The relative stop values of these systems are given below.

F. System.....	f.6.3	f.8	f.11	f.16	f.22	f.32
U. S. System.....	2½	4	8	16	32	64

Anastigmats are frequently termed "fast lenses" and the novice may get a wrong impression of what is actually implied by this term. The amount of light which passes through a given sized opening of a meniscus lens, say stop f.16, which is usually the largest stop of this type of lens, is exactly the same as will pass through an anastigmat at f.16. The exposure would be the same for either lens, as the amount of light that can enter to affect the film depends simply upon the relative area of the lens opening.

As has been stated, the largest stop of the single lens is usually

SIZE	DIAGONAL	LENS
$3\frac{1}{4} \times 4\frac{1}{4}$	5.3 in.	$5\frac{1}{4}$ in.
4 X 5	6.4 "	6 "
5 X 7	8.6 "	$8\frac{1}{4}$ "

Figure 14. Three sizes of cameras, their plate diagonals and the focal length of lenses often used on each.

f.16; that of the rectilinear lens is f.8, twice the diameter of the former, and thus admitting four times as much light. The largest aperture or stop of the anastigmat may be larger than f.2, or the diameter of the lens opening more than one-half the focal length of the lens.

Anastigmats fitted to hand cameras, however, rarely have an opening of more than f.6.3, which admits a little over 60 per cent. more light than the rectilinear lens.

In using these large apertures, or in other words, giving a short exposure with the lens wide open, we lose something that is of extreme importance in scientific photography; the depth of focus. The depth of focus is the degree of sharpness of objects in different planes, or distant and nearby objects in the view that we wish to photograph.

This is a fixed quality in all lenses regardless of the type. Depth of focus depends upon two things; the size or focal length of the lens, and the size of the stop used. The longer the focal length, the less depth; the larger the stop, the less depth.

If we take a 3¼ x 4¼ camera with a f.6.3 anastigmat lens and make a photograph with lens wide open and the distance set for 50 feet, objects from 29 feet to a distance of 170 feet should be sharp. If we make a duplicate photograph, stopping the lens to f.16, objects from 18 feet to infinity, or far as the view extends, should be sharp. Any other 5¼ lens, whether meniscus or rectilinear with stop f.16 will give exactly the same amount of depth and the exposure for all of these lenses will be the same. If, then, we wish to take advantage of the so-called speed of the anastigmat lens, we can only do so by opening up the stops to let in more light and thereby sacrifice the depth of focus in the picture. Fig. 15 shows the relative sized stops of a 5¼ inch lens, with the required exposures and the depth of focus with each stop when the camera is set for 50 feet.

To the average worker, the principal advantage of the anas-

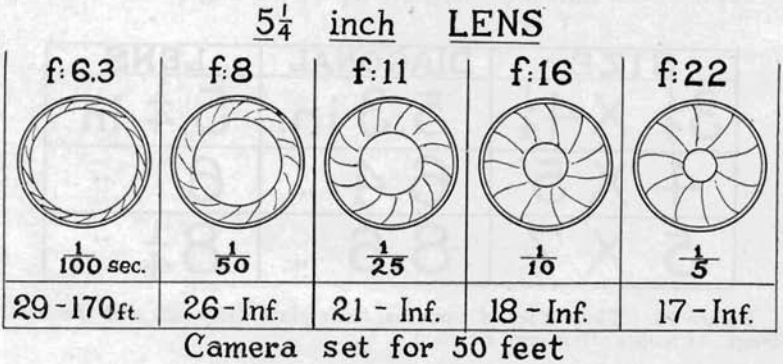


Figure 15. Relative size of the diaphram opening of a 5¼ inch lens with the relative exposures and depth of field with the camera set for fifty feet.

tigmat lens over the rectilinear are the flat field which insures negatives sharp to the edges even when used wide open, and the larger apertures which allow for shorter exposures under unfavorable conditions, although some of the depth must be sacrificed. In general these lenses should be used just the same as a rectilinear.

The loss in the depth of focus with large apertures is more apparent in longer focus lenses such as are used on 5 x 7 to 8 x 10 cameras. This is one advantage in using a small camera for field work. With care in focusing or in using the focusing scale for the principal objects, reasonably sharp negatives can be made with lenses up to the 3¼ x 4¼ size when used wide open. Unless actually cloudy, this will allow exposures of one-hundredth of a second at f.6.3 when photographing spraying operations and similar operations that require a short exposure in order that the movement does not blur the picture.

For photographing insects and their work in the laboratory, it is necessary to have a larger camera with a long bellows. While there are a number of cameras designed for photo-micrograph work, there is no camera on the market that is entirely satisfactory for photographing insects from natural size up to eight or 10 diameters. In our work, we use a 5 x 7 view camera mounted on a stand that allows the camera to be used either in a vertical or horizontal position.

A lens of about four inch focus is used in photographing insects natural size or twice natural size. This requires a bellows extension of twice the focal length for natural size and three times for twice natural size, or eight and 12 inches respectively. In photographing insect eggs or similar small objects, it may be necessary to make the direct photograph six to 10 times natural size. To do this with the four inch lens, it would require a bellows length of 44 inches for the 10 times enlargement; as the camera has only a 22 inch bellows, we use lenses such as are used on motion picture cameras with focal length of only one and one-half or two inches.

The question naturally occurs, how can we use these small lenses designed to use on a film only a little larger than a postage stamp to cover a 5 x 7 plate. We are simply converting the short focus lens into a long focus lens and bringing the object to photograph very near to the lens. As soon as we do this, the values of the stops in the lens are changed in relation to the focal length and the exposure has to be greatly increased in proportion to the given enlargement. If the exposure for natural size is expressed as 1, the increase in exposure for various sized enlargements is as follows:

Times Enlarged...	1	2	3	4	5	6	8	10	12
Exposure.....	1	2¼	4	6	8	12	20	30	42

We are using cut films instead of glass plates in most of our work. Regardless of the argument that the films do not lie flat and are inferior to plates, I feel that we are getting equally good results with the films and they have a number of advantages over the plates. Halation is reduced to a minimum and there is no danger of breakage. They are much lighter in weight and about 25 can be stored in the same space as a dozen plates. Panchromatic films with a set of color screens to be used with them are desirable to bring out colors that will not show contrast on regular or even Orthochromatic films.

In photographing insects or their work in the laboratory, the material is placed on a piece of ground glass with the background two or three inches below to eliminate the shadows. From an artistic standpoint shadows may add to the photograph, but they often detract from and add confusion to scientific photographs which should be as simple and clean cut as possible. The back-

ground is usually a piece of white cardboard, although various tints of gray are used to bring out contrast with light-colored or white objects. Pieces of white cardboard are also set up for reflectors to light the shaded side of the object.

The chief requisite in photographing caterpillars is patience. As a rule the specimens will appear natural only when photographed alive. Better results can be obtained with one to three specimens than where more are included. When possible the specimens should be placed on some of the food plant which shows characteristic work of the species. The food plant must lie as flat as possible, and twigs or leaves out of the general plane should be removed as they will be out of focus in the photograph. Most of the caterpillar photographs are made natural size as enlarging them would require too long an exposure. The lens should be stopped down as much as possible, depending upon the activity of the insects. As we use daylight for most of the exposures, it requires from five to 10 seconds with f.8 stop; more often a smaller stop is used. With the specimens focused and the cap over the lens, the slide is drawn from the plate holder. It is then a case of watching and waiting for the specimens to become still for the required exposure.

Slightly pinching a caterpillar or tapping it with a pencil will sometimes cause it to remain quiet. In some cases it is necessary to stupify the specimens with chloroform but this should only be done when they will remain quiet in no other way.

There are many occasions to make illustrations of adult insects from dead specimens. Though there has been some controversy as to whether the specimens appear more natural to the average person if symmetrically set or photographed without such preparation, in either case a specimen will not appear as in nature and the writer feels that an illustration of an insect is more satisfactory if it shows all six legs than when it gives the impression of having but one or two.

It is often desirable to show butterflies and moths with the wings folded in a resting position. Large specimens can often be photographed alive in a characteristic resting position. Where we wish to show the wing-spread and especially the under wings, carefully set specimens make much better photographs than those set in a careless manner. Pinned specimens are usually set in a piece of cork covered with white paper. Where possible it is well to cut off the head and portion of the pin above the insect close to the body.

In making enlarged photographs of small insects, it is often difficult to focus the object due to a certain amount of play in the camera adjustments. To overcome this an ordinary dissecting microscope has been fitted with a glass object carrier on the lens arm. The object to be photographed is placed on this, the camera bellows set for the right magnification and the object

brought into the focal plane by using the rack and pinion of the dissecting stand.

The exposures in insect photography should be fully timed. If the detail is present in the negative, sufficient contrast can often be obtained with the proper grade of photographic papers. Satisfactory prints, however, cannot be made from under-exposed negatives; if the detail is lacking there is no way to supply it and if possible another negative should be made.

Good insect photographs after all depend largely upon the experience of the operator and his ability to use the available apparatus and materials to the best advantage.

MOSQUITO CONTROL WORK IN CONNECTICUT.

Season of 1924.

R. C. BOTSFORD.

The Director of the Connecticut Agricultural Experiment Station is charged by Statute with the maintenance of drainage works for mosquito elimination, inspected and approved by him. He may also upon request inspect and survey mosquito breeding areas, furnish estimates of cost of treating these areas and supervise or regulate the work. The area of 5,000 acres of ditched salt marsh under State maintenance and contained in nine shore towns was patrolled from April 1 until October 1. Ditches were kept free from obstructions and when found in bad condition, were recut and graded as far as funds would permit. About 155,000 lineal feet were recut. As a result there were but few spots where salt marsh pools would have remained long enough to develop adult mosquitoes. In such cases, oil was sprayed on the pools at the proper time.

The inland or fresh water work is at present limited to making investigations of mosquito infested areas upon request. In such instances, practical advice is given concerning the elimination of each particular breeding place.

Mosquito control work has been generally successful this season and there has been a notable increase of interest shown throughout the State in the mosquito problem.

The expenditures for the year 1924 were as follows:

New work and maintenance work supervised by the State where funds were provided by individuals, associations or towns:

Fairfield	$3,556.97	
Stamford	1,300.00	
Westbrook	1,080.00	
		$5,936.97
Maintenance work in 9 towns (State funds)	5,019.95	
Supervision, tools, etc. (State funds)	2,734.75	
		7,754.70
Total		$13,691.67

The following table shows the present condition of the salt marsh areas in the coast towns. It was prepared from data immediately available and is subject to correction.

Town	Salt Marsh Acres	Salt Marsh Ditched	Maintained by State	Total Cost of Ditching	Labor, Cost of Maintenance 1924	Labor, Cost to Complete
Greenwich	....	....	None	.....	.....	.....
Stamford	300	300	200	$2,800.00	$236.00	.....
Darien	300	300	None	3,800.00	.....	.....
Norwalk	600	600	None	7,500.00	.....	.....
Westport	350	50	50	Ditched with Fairfield	.....	$5,000.00
Fairfield	1,200	1,200	1,200	8,400.00	900.00	.....
Bridgeport	173	....	....	.....	.....	3,000.00
Stratford	1,315	....	....	.....	.....	16,000.00
Milford	630	....	....	.....	.....	8,000.00
West Haven	463	222	222	Ditched with New Haven	194.00	3,500.00
New Haven	750	750	750	12,000.00	592.50	.....
Hamden North Haven	2,042	....	....	.....	.....	25,000.00
East Haven	482	150	50	Ditched with New Haven	42.75	6,500.00
Branford	895	578	578		787.55	4,500.00
Guilford	1,085	1,085	1,085	20,000.00	545.52	.....
Madison	1,005	1,005	1,005		1,674.43	.....
Clinton	766	....	....	.....	.....	10,000.00
Westbrook	500	90	None	1,517.61	.....	5,000.00
Old Saybrook	1,373	60	None	.....	.....	17,000.00
Lyme	493	....	....	.....	.....	7,000.00
Old Lyme	1,393	....	....	.....	.....	17,000.00
East Lyme	424	....	....	.....	.....	5,000.00
Waterford	204	....	....	.....	.....	3,000.00
New London	34	....	....	.....	.....	500.00
Groton	304	50	50	1,000.00	47.20	4,000.00
Stonington	555	....	....	.....	.....	7,500.00
Totals	17,636	6,440	5,190	$57,017.61	$5,019.95	$147,500.00

The Work by Towns.

New Haven.

The town of New Haven contains about 750 acres of salt marsh, all of which was ditched for mosquito elimination during the period from 1912-1917. These salt marsh areas were patrolled continuously from April 1 to October 1, and about 20,500 lineal feet of ditches found in bad condition were recut and graded. Some breeding was discovered where drainage was not yet perfect, but oil was sprayed on the water at the proper time to prevent emergence. There was practically no emergence of mosquitoes from the salt marshes in the town of New Haven in 1924. In spite of this fact, New Haven was more or less infested with salt marsh mosquitoes throughout the summer. This was

due to mosquitoes migrating from breeding places in bordering towns.

It is recommended that a tide gate be placed in Little River at Middletown Avenue.

West Haven.

The salt marshes in the town of West Haven seem to furnish the principal salt marsh mosquito nuisance in New Haven. There are yet about 250 acres of marshes in this town which have not been ditched for mosquito elimination, and in some of these areas breeding places exist throughout the season. A sluiceway with tide gate should be installed in the outlet of the Old Field Creek, extending from Beach Street about 300 feet into the bay, and the creek dredged from Beach Street to Peck Avenue. At times the creek and marsh become so heavily polluted that the killy-fish, the natural enemy of the mosquito, either perish or are driven back into the bay. Mosquitoes breed here in immense quantities. This public nuisance is entirely unnecessary and should be abated.

East Haven.

There are about 482 acres of salt marsh in this town. About 150 acres of this have been treated for mosquito elimination and were kept free from breeding throughout the season. The remaining 332 acres should be treated before relief from mosquitoes can be expected.

The State rifle range was inspected on April 15. Every depression in the wooded area was holding water and breeding mosquitoes. Later in the season when the ranges are in use, these mosquitoes are very troublesome. It is then too late to do anything about it. These breeding places should be filled where practical, or drained or oiled during April, May and June.

Branford.

More than 17,000 lineal feet of ditches were recut and graded in this area since the fall of 1923. A 20 x 24 inch ditch about 400 feet long was dug at Sunset Beach to simplify a drainage problem there. The marsh area under State supervision was thoroughly patrolled throughout the season, and all ditches kept free from obstructions. There was no salt marsh mosquito breeding in this area.

The drainage of the Sybil Creek marsh north of the tide gates on the Indian Neck Road could be improved by a new tile outlet about 400 feet long running eastward and emptying directly into Long Island Sound. More than 317 acres of salt marshes in Branford are not ditched or treated for mosquito elimination.

GUILFORD.

Drainage of the salt marsh areas of this section was well maintained throughout the season. A reported abundance of mosquitoes in one locality led to the discovery of a small corner of salt marsh which will require additional ditches. Repair work was begun on the stone dike at Shell Beach; 25 lineal feet of wall was rebuilt, and this will be continued as funds become available.

MADISON.

Mosquito breeding in Madison was well controlled. Over 8,000 feet of ditches were entirely renewed in the Hogshead Point section. Seven corrugated iron culverts were installed in beaches to replace wooden structures destroyed by storms, and one new 36 inch iron tide gate installed near East River on the Post Road. (See Plate XXXIV

At Hammonassett State Park, labor and oil were furnished by the State Park and Forest Commission to control the breeding in the salt marshes contained in and adjacent to the park. The area was thoroughly patrolled and oiled when necessary, and in addition, more than 43,000 feet of damaged ditches recut. A striking reduction in the number of mosquitoes in the park was reported, due to this work.

WESTBROOK.

The drainage work was started as soon as the weather permitted and continued until the funds were exhausted. This fall more funds were turned over to the Station to continue the work. The ditching of the Fisk marsh and Rushy meadow are practically completed. The culvert draining the Fisk marsh continued to function perfectly throughout the season. The Rushy meadow culvert was relocated and extended 50 feet. Ditching of the Patchougue River marshes near the center of the town was started on December 3 and discontinued on December 20, due to cold weather. Some reduction in the number of mosquitoes was reported this season.

GROTON.

The small ditched area at Groton Long Point was thoroughly patrolled. Ditches were put in good condition by recutting and grading where necessary. No breeding pools existed. The bridge over the marsh outlet should be replaced or a culvert installed in its place.

FAIRFIELD.

The town of Fairfield continues its interest in mosquito elimination and has co-operated with the State throughout the year.

The salt marshes were kept free from breeding the entire season by keeping the ditches cleared and oiling certain pools at the proper time. The fresh water work was continued under the same arrangement as last year, and the drainage work extended and improved. The Fairfield Improvement Association, the town, and individuals supply the bulk of funds for this work from year to year.

STAMFORD.

The Stamford salt marsh area under State maintenance at Shippan Point was well patrolled and the ditches kept open so that the marshes were well drained throughout the season. About 5,500 lineal feet of ditches were recut. No mosquitoes developed on this area. In the meantime, mosquitoes were reported breeding in Southfield marshes, Gourley Tract Swamp and other areas not under State supervision. Upon request of the Health Commissioner of Stamford, an estimate of the cost of treating these breeding places was furnished by the State. The work was started on July 1, and supervised by the State without charge. Eleven thousand feet of old ditches were recut, and 1,300 feet of new ditches and 500 lineal feet of tile and iron pipe were installed. (See Plate XXXIII, b.)

Fresh water breeding places were oiled, and several miles of fresh water ditches cleaned. A reduction in the number of mosquitoes has been reported.

. . . . .

The law passed in 1913, declaring mosquito breeding places a public nuisance and authorizing health officers to abolish them remains on the Statutes and is as follows:

Section 2408. **Mosquito breeding places; treatment.** Any accumulation of water in which mosquitoes are breeding is declared to be a public nuisance. When it has been brought to the attention of a health officer or board of health, through the complaint of any citizen, or when discovered by any inspector or agent of said health officer or board of health, that rain water barrels, tin cans, bottles or other receptacles, or pools near human habitations are breeding mosquitoes, it shall be the duty of said health officer or board of health to investigate and to cause such breeding places to be abolished, screened or treated in such manner as to prevent the breeding of mosquitoes. The health officer, or any inspector or agent employed by him, shall have the right to enter any premises in performance of his duties under this section.

NOTES ON MISCELLANEOUS INSECTS.

Miners in Milkweed Pods: Milkweed pods infested by larvae were collected in Manchester, August 14, 1924, by Mr. J. L. Rogers, Assistant, and were placed in the insectary. On September 27, an adult emerged and another one was obtained on October 25. The adult insect is a black weevil or snout beetle, *Rhyssematus lineaticollis* Say.

Walnut Bud Moth: On June 11, 1924, we received from Mr. B. M. Gillette, Taintor Hill, Suffield, some specimens of brown larvae infesting a Japanese walnut tree. This insect had prevented the owner from obtaining any nuts and is probably the walnut bud moth, *Acrobasis caryae* Grote, though it may prove to be some other related species. In 1912, we had no difficulty in holding this insect in check by spraying thoroughly with lead arsenate.

Sawfly on Arbor-Vitae: On July 10, 1923, Messrs. M. P. Zappe and J. L. Rogers, while in Manchester, noticed some sawfly larvae feeding upon small arbor-vitae nursery trees. A few larvae were found on each tree though no particular injury could be detected. The larvae were grayish green in color, without prominent markings. The material was placed in cages in the insectary and adults emerged on March 10, April 24 and May 22, 1924. Specimens were sent to Mr. S. A. Rohwer, who identified them as *Monoctenus juniperinus* MacGillivray, a species described in 1894 from material collected at Ithaca, N. Y.

Leaf-Roller on Pin Oak: In Fairfield County and in other parts of the State, pin oaks were attacked and in some cases nearly defoliated by a leaf-roller, presumably *Tortrix quercifoliana* Fitch. This insect was observed in New Haven where it caused slight injury, and in Greenwich and Stamford, where it was much more abundant. One pin oak growing naturally in a field north of Stamford was completely stripped by June 9, and is shown on Plate XXV, b. Probably a thorough spraying with lead arsenate would prevent such injury.

Biting Dog Louse in Connecticut: On April 11, specimens were received from Pomfret, of the biting dog louse, *Trichodectes latus* Nitzsch, which had infested a collie dog. The dog had been treated by a veterinarian without complete success. The owner was advised to shampoo the dog thoroughly with a miscible oil that will mix with water. Several treatments may be necessary to get rid of the pest, and a few hours after each treatment, the material should be removed by washing in clear water. This insect belongs not to the Parasitica but to the Mallophaga, and though it is supposed to be quite common, this is our first record of its occurrence in Connecticut.

The Azalea Scale: On June 23, a twig of rhododendron was brought to the Station from the neighboring town of Orange, and on the bark were many small white tufts, that resembled felt. This is the azalea scale, *Eriococcus azaleae* Comst., a species often found on shrubs of the heath family, Ericaceae, and occasionally on Crataegus or hawthorn. We have previously recorded the species from Hartford and New Haven. Both sexes are enclosed in a dense white felt-like sac, ovoid in shape. Should this scale become sufficiently abundant to cause injury, no doubt spraying with a miscible oil, or with nicotine solution and soap would free the plant from the scales.

Tropical Cockroach in Greenhouse: Several adult and immature cockroaches were received from Rowayton, on June 13. They were present in a commercial greenhouse where it had become quite a nuisance. The insect in question is *Pycnoscelus surinamensis* Linn., the same species that became a pest a few years ago in the rose houses of A. N. Pierson, Inc., Cromwell, Conn., by eating the bark from newly-set plants, an account of which has already been published.[1] It was found that the roaches would congregate under boards and in the corners of the benches where they could be surprised by a spray of clear kerosene which brought them to a quick death. Of course this spray must not come in contact with the foliage.

Spiny Caterpillars on Hollyhocks: During June, hollyhocks in the writer's garden were attacked by spiny caterpillars which fed upon the leaves. Some were killed by crushing but no poison was applied. On June 25, material was brought to the laboratory and some parasites were obtained. The species attacking hollyhock was the hop merchant butterfly, *Polygonia comma* Harris. The larva is nearly one and one-half inches in length when full grown and is dark brown on the back with two faint lighter median lines; below the spiracles and the entire ventral surface is light brown. Head and legs, dark brown, prolegs light brown. Each segment dorsally bears a transverse row of branched spines, and many hairs which are light brown. Two parasites emerged on July 8.

Sawfly Feeding on White Pine: Sawfly larvae on white pine were received on July 19 from Mount Carmel where they had defoliated several pine trees. The larvae were whitish, with black spots, and black heads. There were many pupae in the package and also many larvae which had contracted in size, preliminary to pupation. This material was caged in the insectary and on August 8, 13 adult sawflies and four parasites emerged. The species was formerly known as Abbott's sawfly, and occurs in literature under the name of *Lophyrus abbotti* Leach, but is now called *Neodiprion pinetum* Norton. It seems to be quite common

[1] Report Conn. Agr. Expt. Station for 1917, page 302.

in Connecticut and reports are received occasionally of small trees being stripped. Of course, spraying with lead arsenate will prevent defoliation.

Mealy Bug on Taxus: On April 30, specimens of mealy bug were received from Mr. Samuel Stewart, from the premises of Mr. Henry Osborn Taylor, Cobalt. The insects were on yew or Taxus trees growing out of doors. On June 13, more material was received from Mr. Taylor, and some of this was sent to Mr. Harold Morrison of the Bureau of Entomology, Washington, a specialist on scale insects. Mr. Morrison replied that the same scale had been received from Rutherford, N. J., on imported Japanese Taxus. At the time, it was identified as *Pseudococcus kraunhiae* Kuwana, but later Professor G. F. Ferris of Stanford University, Cal., showed that *kraunhiae* is something entirely different. Mr. Morrison has been unable to associate this material with any other described Japanese species, though possibly may later be able to do so. There is of course a possibility that this species has not been described. Shown on Plate XXXV, b.

The Bag Worm: A cocoon was received, May 1, 1923, of the bag worm, *Thyridopteryx ephemeraeformis* Haw., from a garden in New Haven. Eggs hatched in the bag May 11, and the tiny larvae immediately began to make bags for themselves from the leaves of the arbor-vitae twig on which the cocoon was fastened. Miss Finley observed their development and made notes. Some of the larvae tore off particles from the old bag for their coverings but others used green tissue from the leaves. The larvae molted five times inside their bags, which were then suspended by silk threads. Two adults emerged September 7, 1923. This insect, though common in New Jersey and southward, is seldom found in Connecticut unless brought in on arbor-vitae or some other food plant from the south. Occasionally, however, it is seen along the shore and may possibly survive the winters here in case they are mild.

Blue Elm Beetle in Branford: On June 20, I received from the Davey Tree Expert Co., Kent, Ohio, several small blue beetles, which one of their men, Mr. W. W. Tuomey, collected at the base of an elm tree on the grounds of Dr. A. J. Tenney, Branford, Conn. A report was sent to the firm, but on August 4, more specimens were received from Mrs. Tenney. These beetles were present in large numbers around the trunks of some trees close to the ground. This is the same species as has been received from other localities in years past as follows: Salisbury, feeding on elm and hickory, August 14, 1902; Old Saybrook, on elm, April 27, 1908; West Haven, on elm, September 11, 1922. This species is *Haltica* (or *Altica*) *ulmi* Woods, and has been confused with the strawberry flea beetle, *Haltica ignita* Ill., but was described in 1918 by Dr.

Wm. C. Woods as a distinct species.[1] Apparently it feeds upon the foliage of elm trees, but is never as abundant as the elm leaf beetle, *Galerucella xanthomelaena* Schrank (*luteola* Muller) though certain trees may be riddled. The same remedy will protect the trees, namely, spraying with lead arsenate.

European Pine Shoot Moth in Connecticut: On October 13, 1923, twigs of red or Norway pine, *Pinus resinosa*, were received from Dr. Arthur H. Graves, formerly of New Haven, who collected the specimens at Tarrytown, N. Y. The buds had been tunneled, and two brown larvae were present and were identified by B. H. Walden, Assistant Entomologist, as the European pine shoot moth, *Evetria buoliana* Schiff. On November 24, twigs of the same species also showing the work of this insect were received by Mr. W. O. Filley, Forester, from Mr. William Bunker, Ridgefield. On June 19, 1924, twigs of Austrian pine were sent to the Station by Mr. E. A. Jones, Superintendent, Waveny Farm, New Canaan. These had the characteristic crooked growth resulting from injury to the buds by this insect. According to Busck,[2] the larvae cannot be reached by the application of insecticides and the only means of control is to prune off and destroy the infested twigs and buds containing the larvae. This can best be done during the fall and winter.

A Beetle from Europe: On June 1, 1922, a letter was received from Dr. E. P. Felt, State Entomologist of New York, regarding a European beetle, *Heterostomus pulicarius* Linnaeus, which had been found in Albany, Columbia, Niagara, Rennselaer, and probably Essex Counties, in New York State, and which had caused some injury to strawberry blossoms and young fruit in one plantation in Columbia County. It had also been sent to Dr. E. A. Schwarz, Washington, from the Arnold Arboretum, Forest Hills, Mass. Just after receiving Dr. Felt's letter, Mr. H. C. Fall reported on some beetles sent him for identification, and among other things there was one specimen of *Heterostomus pulicarius*, collected at Milford, May 2, 1921, by M. P. Zappe. A note to this effect was published in the Journal of Economic Entomology, Vol. 15, page 311, August, 1922. The genus *Heterostomus* belongs to the family Nitidulidae, and until recently has not been reported from North America. According to Notman[3], it can be separated from *Brachypterus* as follows:

Claws distinctly toothed at base.
Prosternum elevated at tip; elytral epipleurae distinct ..... *Brachypterus*
Prosternum not elevated at tip; elytral epipleurae indistinct ..... *Heterostomus*

[1] Bulletin No. 273, Maine Agr. Expt. Station, page 182, 1918.
[2] Bulletin No. 170, U. S. Department of Agriculture, 1915.
[3] Journal New York Entomological Society, Vol. XXVIII, page 30, March, 1920.

Pine Seedlings Nearly Girdled by Hylobius pales: On July 15, Mr. H. W. Hicock brought to the laboratory from some town in Massachusetts some natural white pine which had been nearly girdled, and which showed the characteristic work of one of the large weevils, *Hylobius pales* Herbst. This form of injury has been studied by Mr. H. C. Peirson[1], who finds that the beetle feeds chiefly at night, and eats off the bark from the stems and sometimes the twigs of young seedlings during May and the first half of June. The eggs are laid singly in the bark of freshly cut pine logs or roots of stumps where lumbering operations are being conducted and hatch in 10 to 14 days. The larvae burrow beneath the bark until they become full grown, which is usually about the first of September, when they pupate in cells beneath the bark, usually going into the sapwood about one-fourth of an inch. The adult beetles emerge in the fall, some as early as September 15, and begin to feed upon the nearest pine seedlings. Most of them go into winter quarters in October. Control measures consist of burning the slash over the stumps in early spring, sawing the logs before the adults emerge, and stacking the lumber in open sunny areas where there are no young pine seedlings in the vicinity.

Western Corn Root Worm in Connecticut: On August 29, 1923, the writer collected in the flowers of marsh mallow, *Hibiscus moscheutos*, at Granby, Conn., two slender green beetles belonging to the family Chrysomelidae. A visit to the same place on September 5, 1924, showed that these beetles were quite common on aster, calendula and some other kinds of flowers in the garden and were feeding upon the petals. Mr. Zappe has identified this beetle as the adult of the western corn root worm, *Diabrotica longicornis* Say, a species which occurs in the Middle Western States, though apparently not previously recorded from Connecticut. It has recently been taken by Mr. K. F. Chamberlain at Cornwall, Conn. A brief note regarding the occurrence of this species in Connecticut was published in the Journal of Economic Entomology, Vol. 17, page 601, October, 1924. The beetles commonly feed on corn pollen and silk, and upon the flowers of squash, cucumber, beans, clover, goldenrod, aster, thistle and other blossoms. The larvae attack the corn roots, eating off the small roots and burrowing in the larger ones, doing considerable damage in the corn belt. So far as is known the larvae feed only upon corn, so a rotation of crops is recommended. It is impossible to foretell whether or not this insect will injure the corn crop in Connecticut. The appearance of the adult beetle is shown on Plate XXX, e.

A European Sawfly Leaf-Miner of Birch: During the summer of 1923, it was noticed in several localities in Connecticut that the

[1] Harvard Forest, Bulletin No. 3, 1921.

sprouts of gray birch, *Betula populifolia*, were attacked by a leaf-miner. The presence of this insect was observed at Rainbow in July during the summer meeting of the Entomologists of the Northeastern United States, and some material was collected and placed in one of the automobiles with a view to rearing the adult, but it was forgotten and became dry. Particularly were the mines noticeable in the terminal leaves of sprouts, but they were seldom present in the older leaves, the leaves on the lateral shoots, or on the larger trees. The larva makes a broad blotch mine often involving half and in some cases nearly the whole area of the leaf. During 1924, Mr. R. B. Friend, Assistant Entomologist of this Station, at my request, collected material and brought to the insectary for the purpose of rearing the adults. On August 6, he obtained a number of small sawflies of both sexes. Specimens were sent to Mr. S. A. Rohwer of the U. S. National Museum, who identified the species as *Fenusa pumila* Klug, a European insect which up to this time was not known to occur in the United States. A brief note regarding the matter was published in the Journal of Economic Entomology, Vol. 17, page 601, October, 1924. Since then we have observed the work of the insect in many parts of the State, and Dr. Felt informs me that he has seen its work throughout eastern New York. The appearance of the mined leaves is shown on Plate XXXV, a.

Sawfly Larvae Defoliating Honeysuckle: On June 10, 1923, the writer noticed on Barnett Street, New Haven, a wire fence covered with climbing honeysuckle, *Lonicera* sp., the leaves of which had been mostly devoured. A hasty examination showed that sawfly larvae were responsible for the defoliation, and many were present and feeding. On June 15, 1923, Mr. E. M. Stoddard, Pomologist of this Station, brought to the laboratory additional specimens of the same kind of insect which he found feeding upon honeysuckle in Hamden. Two adults from the Hamden material emerged on March 24, 1924, and one adult from the New Haven material emerged on April 30. Both lots produced adults of the same species, which is one of the larger sawflies, *Abia americana* Cresson. The larvae are nearly an inch in length when full grown and are dull gray in color with yellowish dorsal and latero-ventral stripes. A row of black spots extends the entire length of the back in the middle of the yellowish stripe. Head, dark brown or black; legs, prolegs and ventral surface, yellowish. On July 18, 1924, larvae of this species were received from Mr. J. E. Hopkins of Thomaston, which had completely defoliated a cultivated bush honeysuckle in the village of Northfield. Another species, *Abia inflata* Norton, also feeds on honeysuckle, and on July 7, 1915, larvae were received from Dr. Williams, Bristol. Adults were obtained April 27, 1916. Of course spraying with lead arsenate is a simple remedy to prevent defoliation of honeysuckle shrubs and vines whenever these larvae become abundant and troublesome.

Rudbeckia "Golden Glow" Stripped by Sawfly Larvae: On July 11, 1924, the writer visited the truck farm of Mr. H. E. Baldwin, Bayberry Lane, Westport, in company with Messrs. M. P. Zappe, Assistant Entomologist, Dr. G. P. Clinton, Botanist, and W. R. Hunt, Graduate Assistant in Botany. While there, we noticed a bed of *Rudbeckia laciniata*, "Golden Glow," about 12 feet long and perhaps half as wide which had been stripped of its leaves by sawfly larvae. Most of the larvae had left the plants, but some remained and many were found crawling on the ground and in the grass near the flower bed. Mr. Zappe and I collected some material and carried to the insectary with a view to rearing the adults. The full grown larva is about three-fourths of an inch long, ground color light gray or dirty white with a darker gray median stripe, and a row of rather large black spots on each side about half-way between the spiracles and the median stripe. Around the spiracles there are small black dots, two on each thoracic segment and the last abdominal segment, and four on each of the other abdominal segments. Head, black on upper surface and more than half of face; lower portion of head, legs, prolegs and ventral surface of body, light gray or dirty white with yellowish tinge. Mr. R. B. Friend, Graduate Assistant in Entomology, visited the place on July 18, and collected more material and brought home some plants of golden glow upon which to feed the larvae. From all this material, only one adult has been obtained, and it emerged on August 15. This was sent to Mr. S. A. Rohwer of the U. S. National Museum, who identified it as *Tomostethus inhabilis* Norton, a species supposed to feed on pear. As there were pear trees near the golden glow, it is quite possible that a larva from a pear tree was collected with the others which were feeding on golden glow. The species causing the stripping is therefore uncertain, and it is hoped that more material may be obtained next season in order to settle the identity of the species. The larvae and defoliated plants are shown on Plate XXXVI.

INDEX.

a. Infestation No. 1, Burlington, where 14 egg-clusters were found in this apple orchard. Photo April 10, 1924.

b. Infestation No. 5, Windsor, where 16 gipsy moth egg-clusters were found on willows. Photo April 10, 1924.

GIPSY MOTH INFESTATIONS.

PLATE XVIII.

a. The only infestation found in New Haven, on Howard Avenue, near the railroad bridge, on cherry and rose bushes, where six egg-clusters were found. Photo April 16, 1924.

b. Infestation No. 3, Granby, on white oak and cherry. Photo November 27, 1923.

GIPSY MOTH INFESTATIONS.

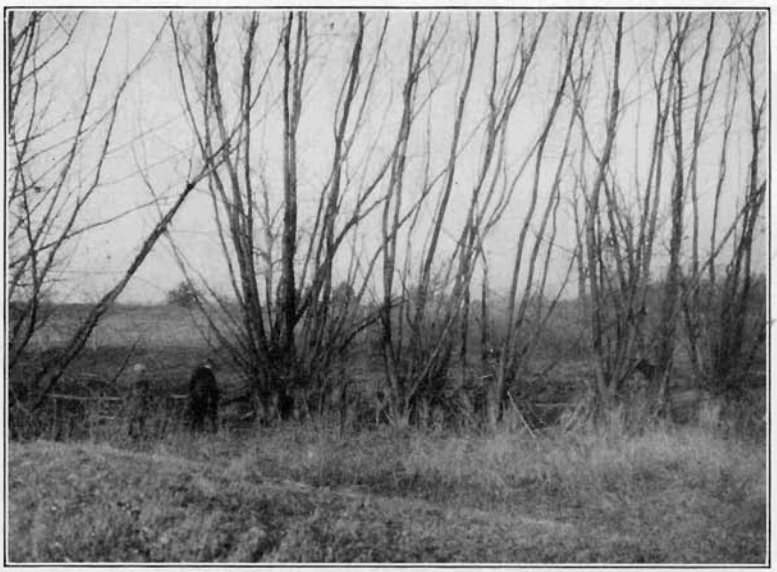
a. Infestation No. 6, Hartford, on North Meadows, near Windsor Line; 936 egg-clusters were found here. Photo March 26, 1924.

b. Infestation No. 5, New Britain Avenue, Hartford. Forty-two egg-clusters were found here on trees and on buildings. Photo, April 10, 1924.

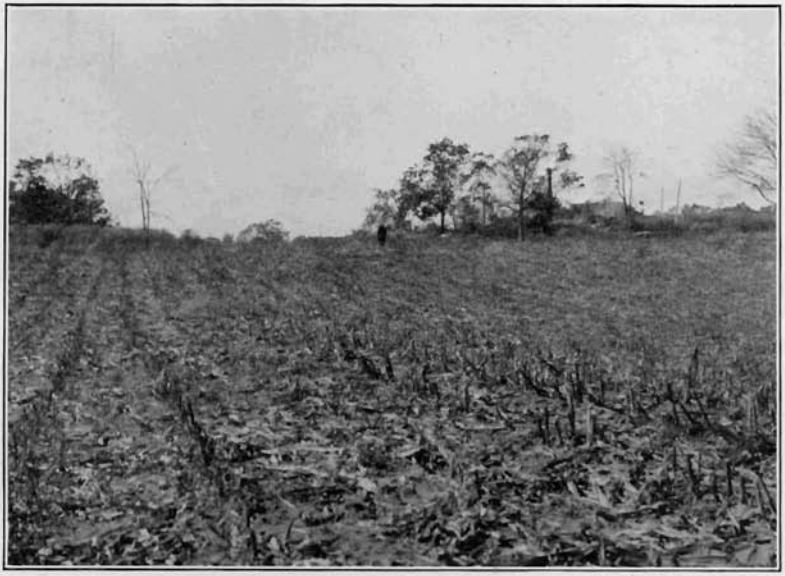
GIPSY MOTH INFESTATIONS.

PLATE XX.

a. Infestation No. 14, Suffield, on willows in pasture. Photo November 27, 1923.



b. Infestation No. 17, Suffield. On this willow hedge surrounded by meadow land, 650 egg-clusters were found. Photo November 27, 1923.



a. Bridgeport infestation, Hillside Home, showing stubble and weeds before burning.

b. Burning stubble in an adjacent field, Bridgeport.

EUROPEAN CORN BORER INFESTATIONS.

PLATE XXII.

a. New Haven infestation, showing broom corn which has grown from seed where clippings had been thrown on dump.

b. Broom corn clippings on dump along Peat Meadow Road, near Grannis Corner, New Haven.

EUROPEAN CORN BORER INFESTATIONS.

a. Infested garden in rear of broom corn factory, Townsend Avenue, Grannis Corner, New Haven, before burning.

b. Same as above; photo taken during the burning operations.

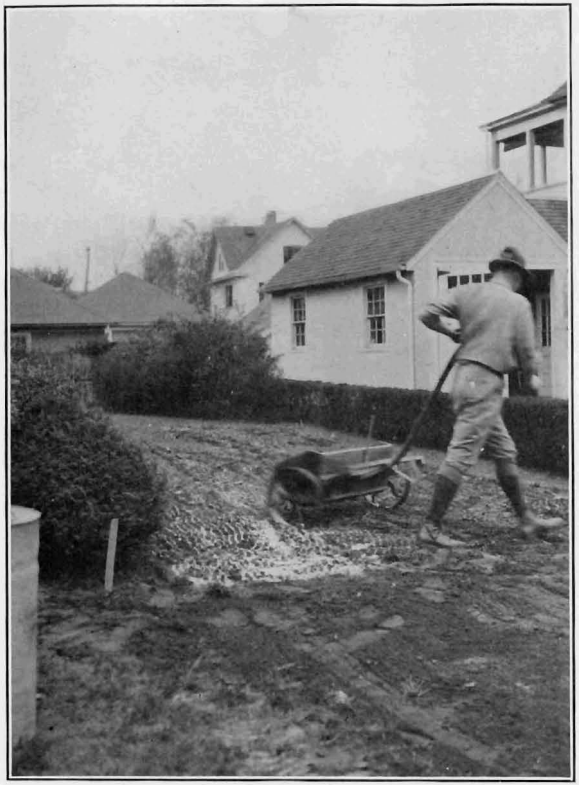
EUROPEAN CORN BORER INFESTATIONS.

PLATE XXIV.

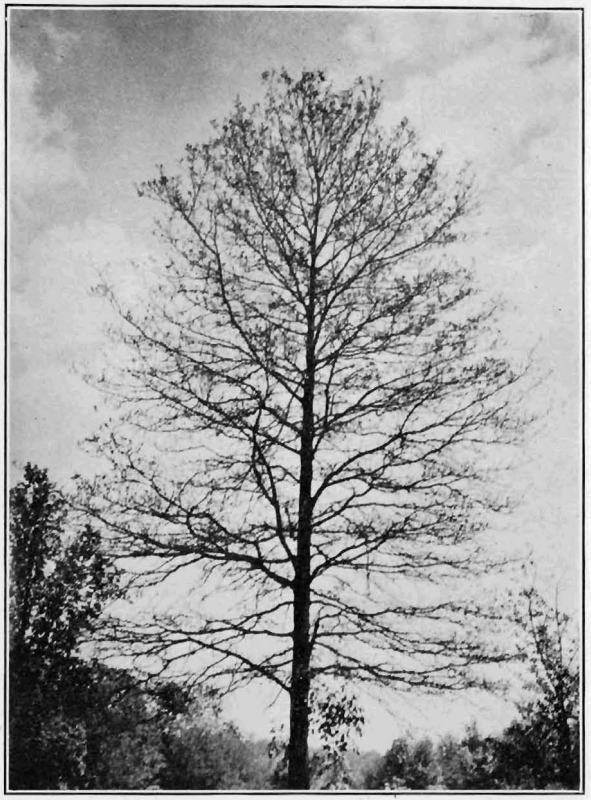
a. Method of distributing carbon disulphide emulsion on lawn infested with grubs.

b. Soaking down an infested lawn after applying insecticide to kill the grubs.

ASIATIC BEETLE INFESTATIONS.



a. Asiatic beetle infestation. Applying cyanide with fertilizer drill.

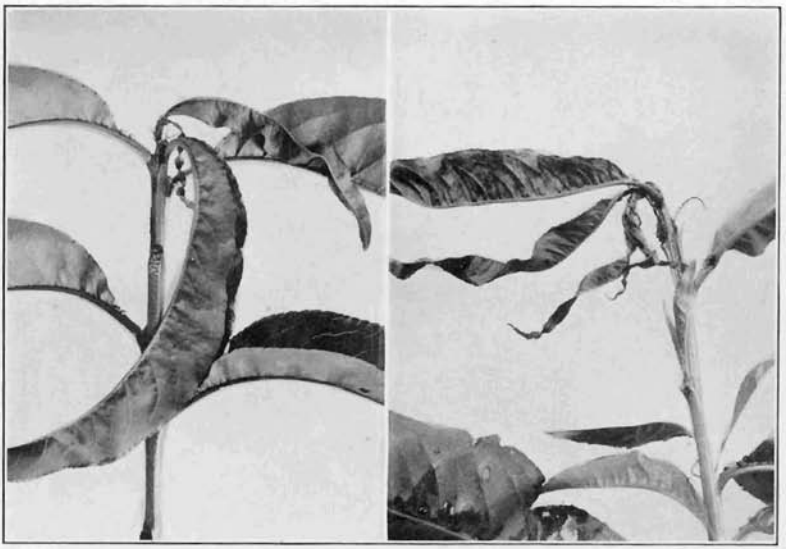


b. Pin oak nearly defoliated by oak leaf-roller.

ASIATIC BEETLE INFESTATIONS AND OAK LEAF-ROLLER.

PLATE XXV.

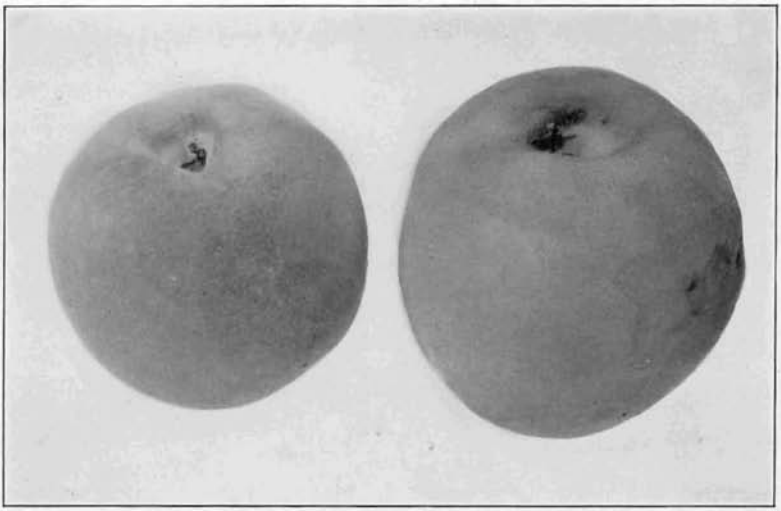
PLATE XXVI.



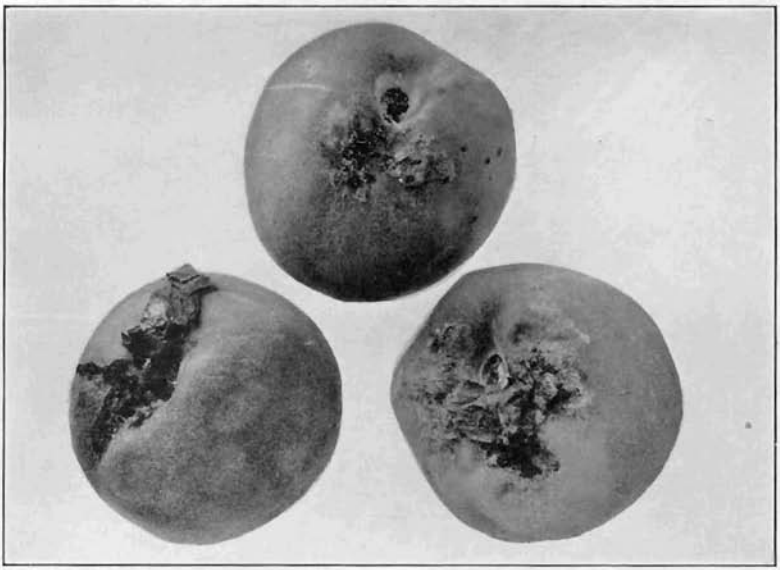
a. Newly infested twig, left; more advanced stage, right.

b. Injured twig after the larva has abandoned it, left; similar twig still later showing how laterals are forced out.

ORIENTAL PEACH MOTH.



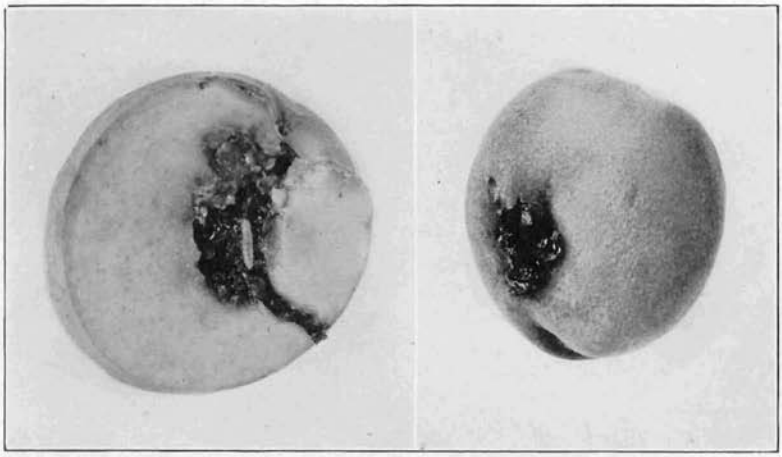
a. Ripe fruit with inconspicuous entrance marks of larvae near stems, late brood.



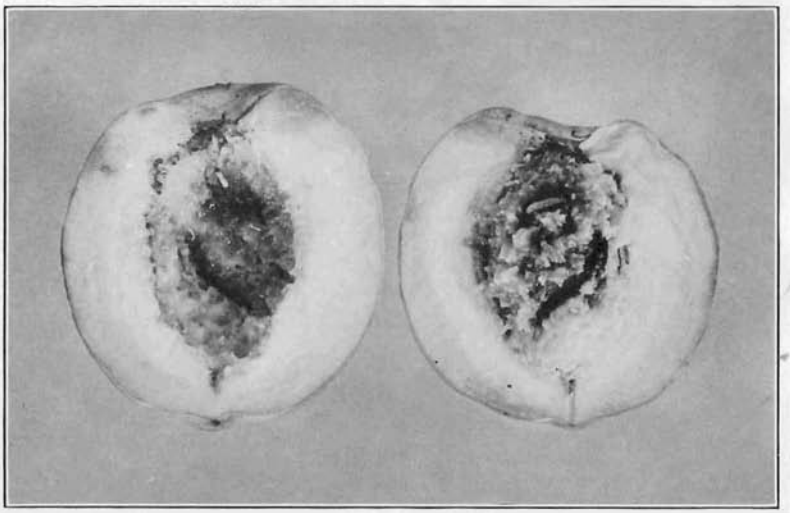
b. Exterior marks of infestation, early brood.

ORIENTAL PEACH MOTH.

PLATE XXVIII.

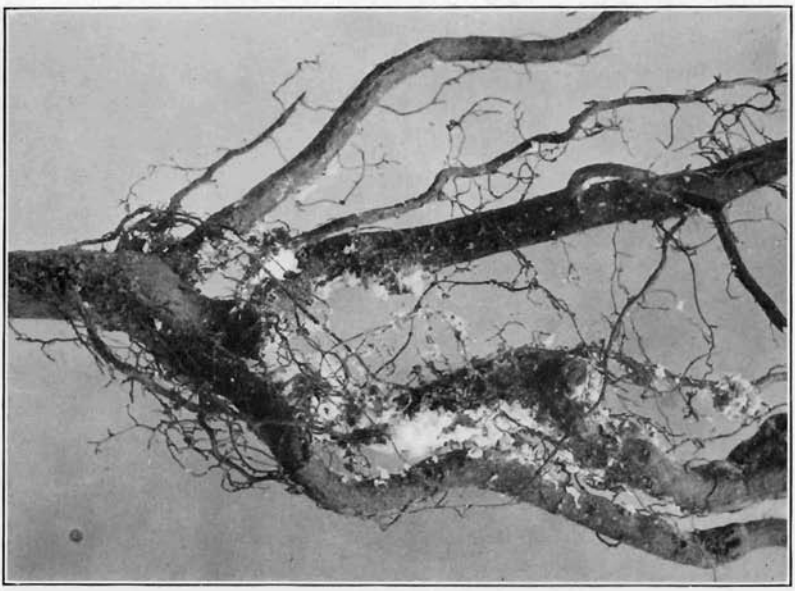


a. Peach with nearly full grown larva, left; exterior marks of infestation right.

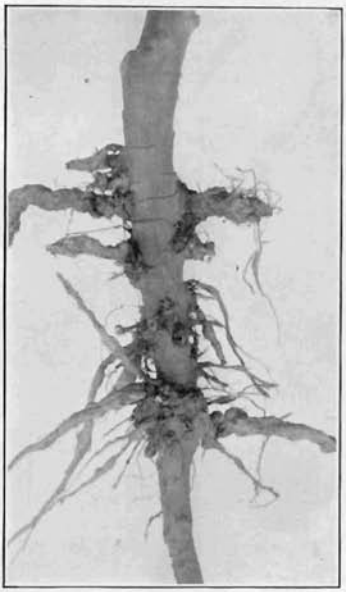


b. Ripe peach containing two larvae.

ORIENTAL PEACH MOTH.



a. Woolly apple aphid on roots of young trees.

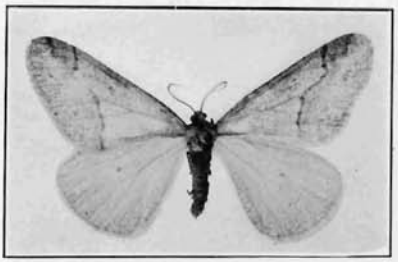


b. Nursery tree from the south. Feeding roots destroyed by decay following woolly aphid galls.

c. Woolly aphids on twigs, showing galls and white flocculent appearance.

WOOLLY APHID OF APPLE AND ELM.

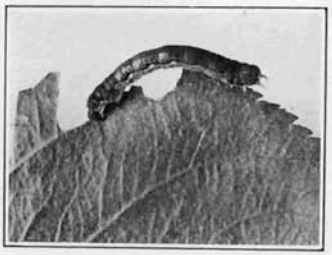
PLATE XXX.



a. Lime tree winter moth; male, natural size.

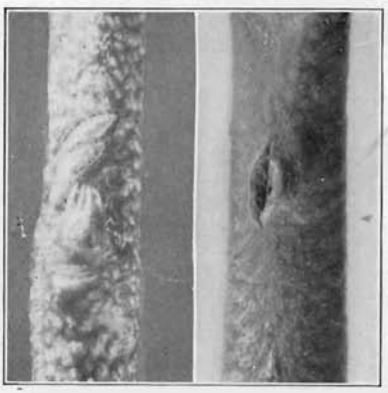
b. Lime tree winter moth; female, twice enlarged.

c. Lime tree winter moth; eggs, twice enlarged.



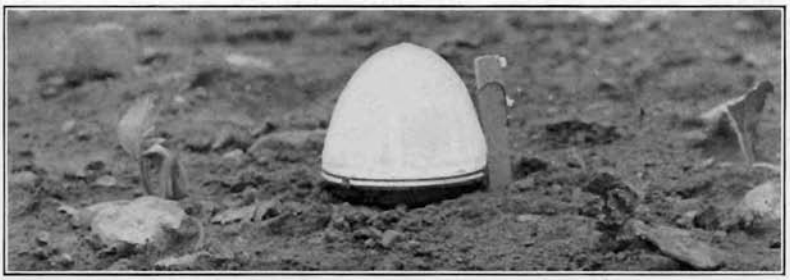
d. Lime tree winter moth; larva, natural size.

e. Western corn root worm, adult, four times enlarged.

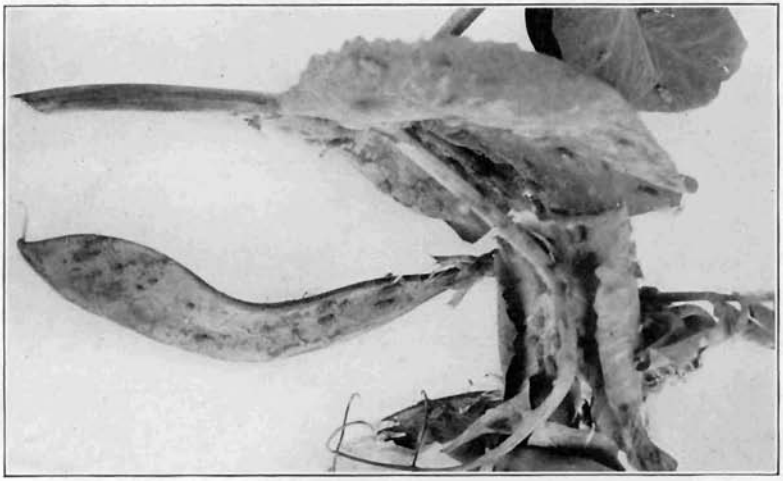


f. Blueberry spittle bug; left, twig with bark removed showing eggs; right, old egg-scar.

LIME TREE WINTER MOTH, WESTERN CORN ROOT WORM AND BLUEBERRY SPITTLE INSECT.



a. Trap used in experiments in attracting cabbage maggot flies.



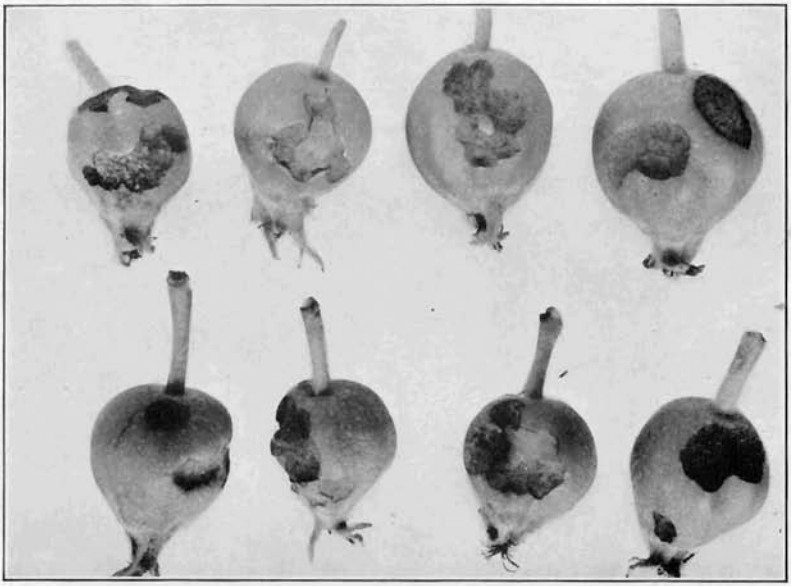
b. Section of pea vine infested with the pea aphid.

c. Applying nicotine dust to pea vines to kill aphids.

FLY TRAP AND PEA APHID.

PLATE XXXII.

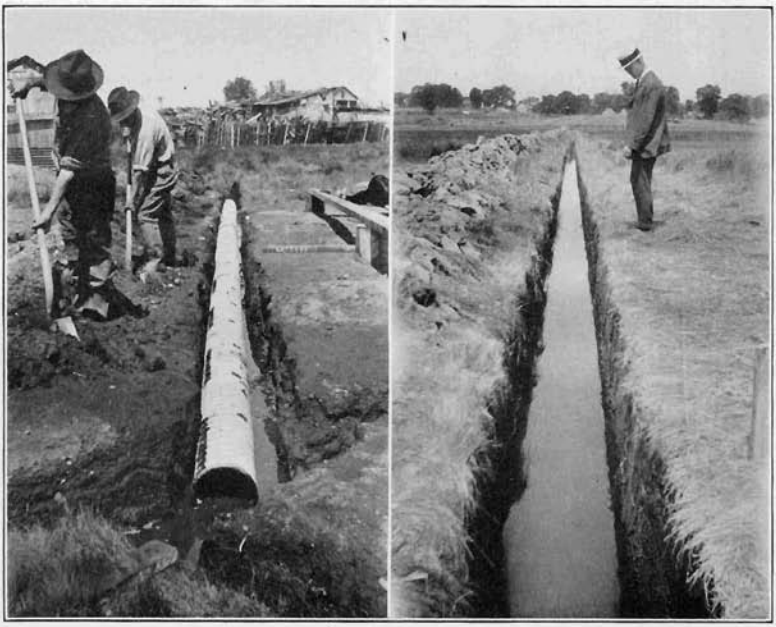
a. Elm trees on Whitney Avenue, New Haven, nearly defoliated by canker worms, May, 1924.



b. Young apples from Station Orchard, Mount Carmel, eaten by canker worms.

CANKER WORM INJURY.

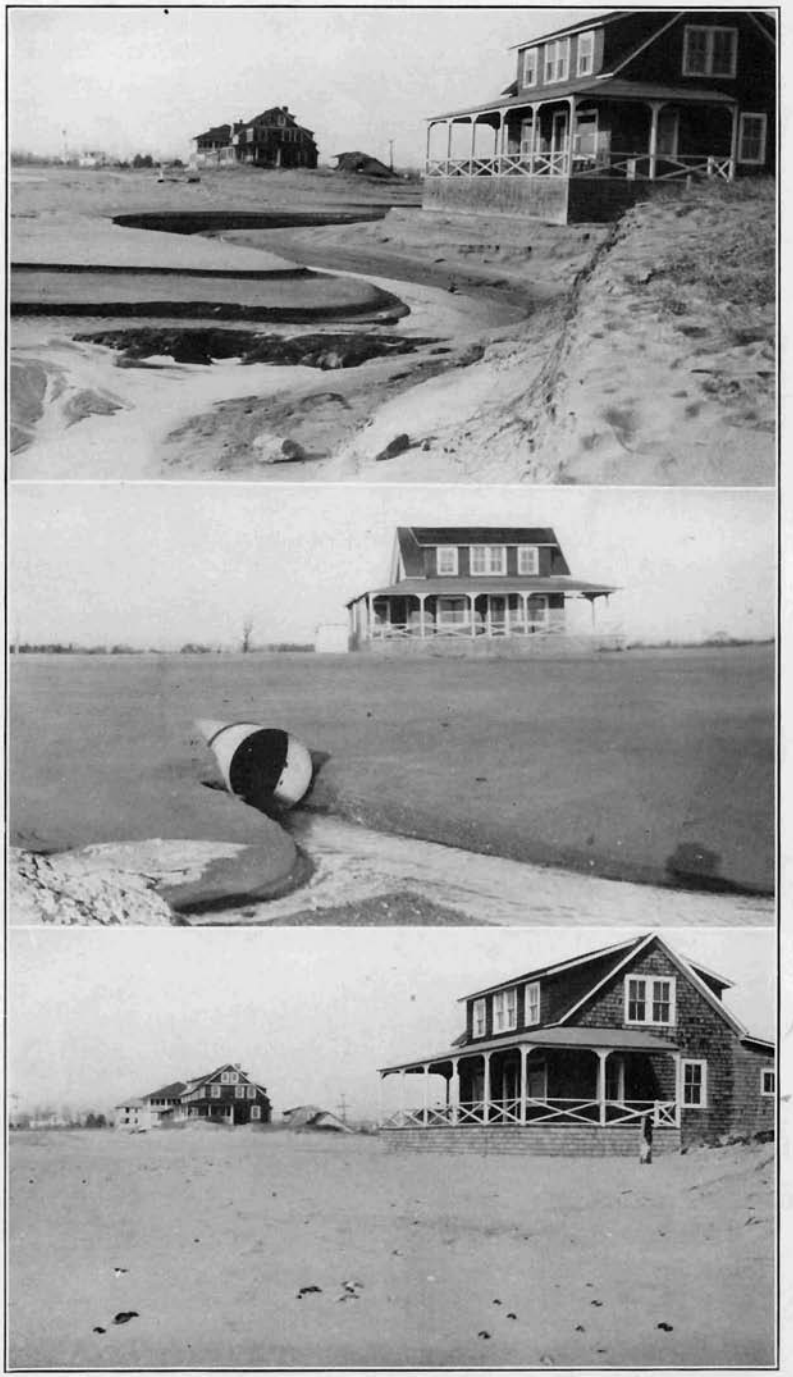
a. Collecting *Anopheles* larvae in ornamental pool.



b. Laying 10 inch corrugated pipe Gourley Tract, Stamford.

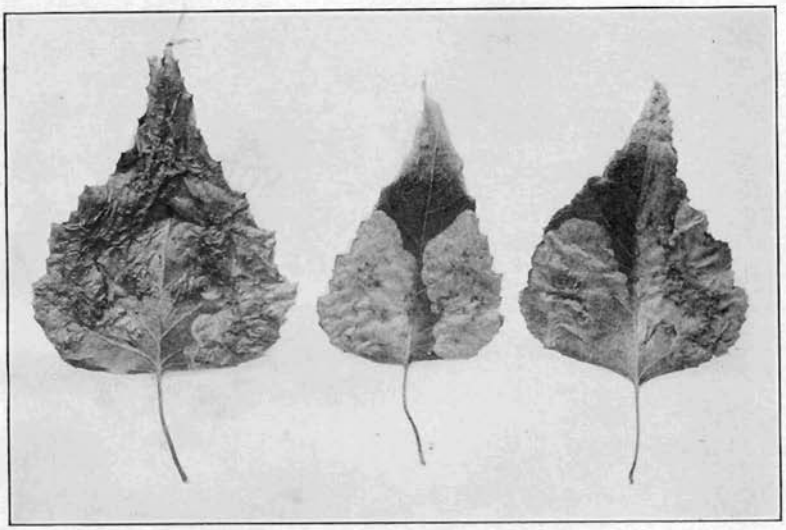
c. Main drainage ditch at Southfield Point, Stamford.

MOSQUITO WORK.



Above. Marsh outlet requiring continual labor to keep open.
Center. Two hundred and twenty feet of pipe installed gives perfect drainage.
Below. Conditions one year later; natural sand fill removes danger of undermining cottage.

MOSQUITO WORK, MADISON.

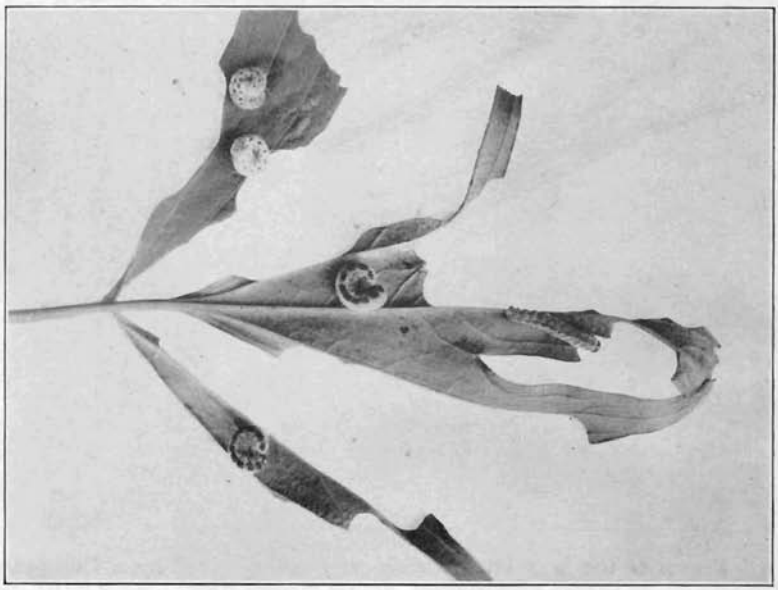


a. Leaves of the gray birch, *Betula populifolia*, mined by a European sawfly leaf-miner, *Fenusa pumila* Klug.

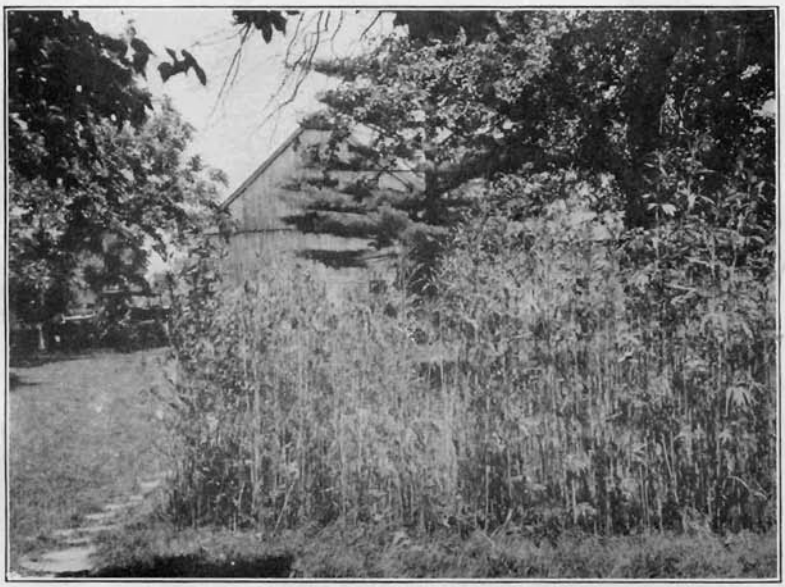
b. Taxus grown out of doors and infested by a mealy bug, *Pseudococcus* sp.

EUROPEAN SAWFLY LEAF-MINER AND MEALY BUG.

PLATE XXXVI.



a. Sawfly larvae feeding on Rudbeckia "golden glow", natural size.



b. Bed of Rudbeckia "golden glow", Westport, which had been stripped by sawfly larvae.

SAWFLY LARVAE ON RUDBECKIA "GOLDEN GLOW".