Bulletin 315 April, 1930

TWENTY-NINTH REPORT CONNECTICUT STATE ENTOMOLOGIST 1929

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

Connecticut
Agricultural Experiment Station
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Authorship

For bibliographical purposes all material published in this bulletin, unless otherwise indicated, should be credited to W. E. Britton.

Illustrations

The illustrations in this bulletin are from the following sources: Figures, all from line drawings; 45, 50, 52, 53, 54, 55, 56, 57 and 58, maps prepared by B. H. Walden; 46, 47, 48 and 49 by R. B. Friend; 51 by Philip Garman. Plates, all from photographs; XIII, a, from Massachusetts Department of Agriculture; XXI, a and c, from Burgess and Crossman, Bureau of Entomology, United States Department of Agriculture; XVI, XVII, and XIX, a, by J. P. Johnson; XXV, b, by W. O. Filley; XIII, b, and XIV by W. E. Britton; XXVIII by R. C. Botsford; all others by B. H. Walden.

TWENTY-NINTH REPORT
CONNECTICUT STATE ENTOMOLOGIST

1929

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

I have the honor to transmit herewith my twenty-ninth report as State Entomologist of Connecticut. A comprehensive account of the Oriental peach moth, prepared by Doctor Garman, has been published as Bulletin 313. The official inspection and control operations prescribed by Statute are given in some detail, as well as a review of the various quarantines and their enforcement. One important development of the year was the discovery in Connecticut of the Mexican bean beetle. Other brief papers indicate the research and observations of members of the department staff.

Respectfully submitted,

W. E. BRITTON,
State and Station Entomologist.

FINANCIAL STATEMENT

Report of Receipts and Expenditures of the State Entomologist July 1, 1928, to June 30, 1929.

Receipts

Insect pest appropriation, biennial period ending June 30, 1929	$60,000.00	
Deficiency appropriation	15,000.00	
Miscellaneous receipts, refunds, etc.	570.68	
	$75,570.68	
Expended to June 30, 1928	38,915.41	
Balance available July 1, 1928		$36,655.27

Expenditures

Salaries	$18,710.00	
Labor	7,936.43	
Stationery and office supplies	142.39	
Scientific supplies (chemicals)	22.94	
Scientific supplies (other laboratory supplies)	22.58	
Scientific supplies (photographic supplies)	95.11	
Insecticides, etc.	804.11	
Lumber and Small Hardware	3.40	
Miscellaneous Supplies	110.46	
Automobile Oil	144.53	
Fertilizer	10.00	
Telegraph and Telephone	188.02	
Postage	71.50	
Travel expense (outlying investigations)	2,759.29	
Travel expense (meetings, conf., etc.)	364.14	
Travel expense (gasoline for automobiles)	731.44	
Freight, express and parcel post	38.98	
Publications (bulletins, annual reports)	33.25	
Electricity	39.24	
Furniture and fixtures (new)	491.19	
Furniture and fixtures (repairs)	23.45	
Library (books and periodicals)	89.44	
Scientific equipment (new)	570.39	
Scientific equipment (repairs)	1.35	
Automobiles (new)	581.00	
Automobiles (repairs)	339.99	
Tools, machinery and appliances (new)	145.49	
Tools, machinery and appliances (repairs)	2.25	
New buildings and structures	709.69	
Buildings (repairs and alterations)	15.15	
Rent of land and buildings	58.75	
Contingent insurance	54.92	
Miscellaneous contingent expenses	131.84	
Total disbursements	$35,442.71	
Balance on hand June 30, 1929	1,212.56	
		$36,655.27

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.*
Roger B. Friend, Ph.D., *Research Work.*
} *Assistant Entomologists.*

J. F. Townsend
B. W. McFarland
John C. Schread, M.S.
W. Theodore Brigham, B.S.
} *Technicians.*

J. Peter Johnson, B.S., *Deputy in Charge of Asiatic and Japanese Beetle Quarantines.*
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.*
Mrs. Gladys Brooke, B.A., *Secretary.*
H. W. Coley, Westport
A. W. Yates, Hartford
} *Apiary Inspectors.*

Mr. Walden has continued as chief photographer for the department and has been in charge of the office during the absence of the Entomologist. He has had charge of certain exhibits, and devoted a part of his time to the identification of insects and work on the collection, together with inspection and general work of the department. He has also continued his researches on the imported currant worm, *Pteronidea ribesi* Scop.

Mr. Zappe has continued as chief nursery inspector and with his helpers has inspected all stock in the nurseries of the State. The number of nurseries has increased from year to year. He has also inspected the nursery stock imported into Connecticut from foreign countries. With Mr. Stoddard, of the Botany Department, he has visited a number of orchards in order to gather data on the prevalence of insect pests and to advise owners regarding treatment. Mr. Zappe has spent considerable time identifying insects and caring for the collection as a specialist in the order Coleoptera, or beetles. With Mr. T. M. Cannon and other Federal men, he has helped distribute information regarding the European corn borer throughout the infested area and will have charge of clean-up work next spring, as in former years.

Doctor Garman has devoted some time to mites and dragonflies, but most of his efforts have been placed on the control of the Oriental peach moth, *Laspeyresia molesta* Busck, which has increased in abundance and caused serious injury in many peach orchards. Doctor Garman has succeeded in rearing several parasites of the Oriental peach moth, two of which are quite common in certain orchards and can be reared artificially for liberation in orchards where they are not abundant. In late summer the peach growers requested the Station to undertake the rearing of these parasites, made contributions to a fund and obtained a state appro-

priation for this purpose. Equipment has just been installed for parasite work and will be described later. Doctor Garman has also given much attention to the subject of oil sprays.

Doctor Friend has continued his observations and experiments on treating lawns with lead arsenate as a control for the Asiatic beetle, *Anomala orientalis* Waterhouse. He has also continued observations on the life history and habits of the imported birch leaf-miner, *Fenusa pumila* Klug, which we hope can be completed in another season. Doctor Friend has experimented in the control of the cabbage maggot and the squash-vine borer at the Station farm at Mount Carmel and in coöperation with the gipsy moth men has gathered data on the cost of spraying woodland areas. During the year Doctor Friend has given two courses in entomology in Yale University, and has given considerable attention to the Diptera in the Station collection.

Mr. John T. Ashworth has continued as deputy in charge of gipsy moth control work with headquarters at Danielson, with Mr. J. A. McEvoy as assistant. This work includes scouting and creosoting egg-clusters, spraying around infestations, collecting parasitized material, liberating parasites, and is conducted in coöperation with the Federal Plant Quarantine and Control Administration and Bureau of Entomology; it has been carried on vigorously during the past season.

Mr. J. Peter Johnson has continued in charge of the quarantine enforcement and control of the Japanese beetle and the Asiatic beetle that is conducted in coöperation with the Federal Plant Quarantine and Control Administration. An office has been maintained in Shelton, but on July 1, 1929, it was moved from the Hurley Building to the Pierpont Building on Howe Street. Mr. Johnson has had a force of men sufficient to make the necessary inspections, issue the required certificates, patrol the principal highways leading out of the quarantined area, visit growers, and in summer to scout for beetles in other cities and towns in Connecticut outside of the quarantined area.

Mr. Robert C. Botsford has continued as deputy in charge of the work of eliminating mosquitoes. He makes preliminary surveys, supervises the ditching work, and maintains the ditches that have been accepted for state maintenance under Section 2, Chapter 68, Public Acts of 1923. Important new work has been done during the season in Old Lyme and Hamden.

Four technicians are now employed: B. W. McFarland, on Asiatic beetle investigations and control; J. F. Townsend, on Oriental peach moth investigations and control; J. C. Schread and W. Theodore Brigham, on Oriental peach moth parasites, beginning late in the season.

Mr. A. F. Clark was employed from July 1 to August 31; Mr. J. G. Conklin from June 18 to September 21, and Mr. Harold

B. Bender from July 1 to September 30, to assist Mr. Zappe in the work of inspecting nurseries.

Mr. W. E. Devine was employed for the school vacation as a general helper in office and laboratory.

Mr. Neely Turner, who is employed by the Crop Protection Institute on horticultural oil spray investigations, has been associated with the department and has been furnished office and laboratory facilities by the Station.

Mr. A. W. Yates, Hartford, and Mr. H. W. Coley, Westport, have continued to serve as apiary inspectors as in former seasons on a *per diem* basis.

Mrs. Gladys Brooke has served as Secretary to the department. During her vacation, Mrs. A. D. McDonnell was employed for part time to attend to the correspondence and other necessary work.

Miss Hazel B. Gillespie, a graduate student in Yale University, was employed during the summer vacation period to index the entomological literature in the journals, and the bound volumes are now nearly all indexed.

All members of the department staff and others mentioned have rendered faithful and efficient services, without which it would have been impossible to obtain the results already accomplished. To them the Entomologist hereby expresses his appreciation and thanks.

The attention of the Entomologist has been given to the office correspondence and to directing the research, inspection, quarantine and control work of the department. Much time has been devoted to meetings and conferences regarding some phase of insect control. The Entomologist has retired from the associate editorship of the *Journal of Economic Entomology,* but he is still chairman of a committee on the project of horticultural oil sprays of the Crop Protection Institute, insect pest reporter in Connecticut for the Insect Pest Survey of the Bureau of Entomology, chairman of the Tree Protection Examining Board of Connecticut, and Superintendent of the Connecticut Geological and Natural History Survey, and has devoted some time to each of these matters.

The principal activities of the department appear in greater detail in the following pages of this report.

Exhibits

Several exhibits were made by the department during the season. The New Haven Garden Club requested that an exhibit of the Asiatic beetle be made at the spring flower show in Trinity Parish House, New Haven, on May 17. This exhibit was shown and later was repeated at the New Haven Lawn Club. The same material was shown for two weeks in the show window of a hardware store.

On August 5, an exhibit under the auspices of the Litchfield Garden Club was set up in the high school at Litchfield and remained for a week. On October 8 an exhibit was made at the meeting of the Madison Garden Club, at Madison.

A small exhibit of insects attacking vegetable crops was shown in Hartford, December 3 and 4, at the annual meeting of the Connecticut Vegetable Growers Association. A small exhibit of European corn borer and injury caused by this pest was arranged for a meeting to consider the corn borer quarantine, held at the Station, November 7.

An exhibit of Oriental peach moth material was also prepared for use in Glastonbury.

Collection of Insects

Additions to the Station insect collection are constantly being made by members of the staff and by correspondents. Though no important collecting trips were made, Doctors Garman, Friend and Britton collected in Portland, East Haddam, Salem and Montville in June.

Mr. W. E. Manchester, Pleasant Valley, sent in some specimens of mayflies, flies and dragonflies taken near his home. Prof. C. P. Alexander of Amherst, Mass., collected in Norfolk and Granby chiefly for craneflies, but saved all Diptera and sent many specimens for our collection. Dr. E. P. Felt and Mr. S. W. Bromley, of Stamford, also contributed many specimens of Diptera and some captures in other orders.

New Equipment

Some second-hand filing cabinets and book sections were purchased and a portion installed in the office of the department; the remainder and our old adding machine were assigned to the Japanese beetle office in Shelton. A new adding machine and typewriter were purchased for the office and a new high-power compound microscope and 5 x 7 view camera for the laboratory of the department. An engineer's dumpy level and planimeter were bought for use on mosquito elimination work.

Late in the season, there was purchased for the parasite work a large electric refrigerator and a humidifier. Several incubators, breeding cages, and a constant high-temperature room were constructed by our own technicians.

SUMMARY OF OFFICE AND INSPECTION WORK

409 samples of insects received for identification.
288 nurseries inspected.
288 regular certificates granted.
222 duplicate certificates issued for filing in other states.

1 special raspberry certificate granted.
8 special miscellaneous certificates granted.
104 nursery dealer's permits issued.
258 shipper's permits issued to nurserymen in other states.
352 parcels of nursery stock inspected and certified.
42 bales of mountain laurel and other decorative material inspected and certified for shipment.
22,000 narcissus bulbs inspected and certified.
1,084 shipments of corn and other seed inspected and certified.
334 blister rust control area permits issued.
32,926 Japanese beetle certificates on nursery and floral stock and farm products.
855 Asiatic beetle certificates on soil and plants.
76 orchards and gardens examined.
23 shipments, containing 225 cases, 2,022,475 plants imported nursery stock inspected.
11 shipments or 47 per cent found infested.
990 apiaries, containing 9,559 colonies, inspected.
2 apiaries and 3 colonies found infested with European foul brood.
46 apiaries and 115 colonies found infested with American foul brood.
4,369 letters[1] written on official work.
942 circular letters sent out.
270 post cards sent out.
23 reports to Federal Plant Quarantine and Control Administration.
2,453 bulletins, etc., mailed on request or to answer inquiries.
36 packages sent by mail or express.
54 lectures and addresses at meetings.

PUBLICATIONS OF THE DEPARTMENT, 1929

W. E. Britton:

Twenty-Eighth Report of State Entomologist, Bull. 305, 100 pages, 16 plates, 8 figures. June, 1929.

The European Corn Borer, a Menace to Corn, Vegetable and Garden Plants, Bull. Imm. Inf. 63, 4 pages, 2 figures, 12,000 copies. April 17, 1929.

Japanese Beetle Quarantine, Bull. Imm. Inf., 4 pages, 4 figures, 6,250 copies. May 1, 1929.

Asiatic Beetle Quarantine, Bull. Imm. Inf. 65, 4 pages, 4 figures, 5,000 copies. May 3, 1929.

Satin Moth Quarantine, Bull. Imm. Inf. 66, 3 pages, 2 figures, 1,200 copies. May 3, 1929.

Control of Ant Invasions, Bull. Imm. Inf. 67 (Revision of No. 17), 6 pages, 2 figures, 5,000 copies. August 22, 1929.

Report of Committee on Injurious Insects, Proceedings 38th Annual Meeting Conn. Pom. Society, 28. April, 1929.

Insects Injuring Vegetable Crops in 1928, Report of Committee on Insects, Conn. Veg. Growers Assn., 26.

Thirteenth Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1927-1928, Bull. 45, 32 pages, 3 plates, 2,500 copies. August 13, 1929.

Three Corn Crop Pests, Rural New-Yorker, **88**: 1225. October 5, 1929.

[1] Including 1,078 written at the Shelton Japanese Beetle office.

Philip Garman:

The Oriental Peach Moth Situation, Proceedings, 38th Annual Meeting, Conn. Pom. Society, p. 102. April, 1929.

The Use of Oil Sprays, Proceedings, 38th Annual Meeting, Conn. Pom. Society, 50. April, 1929.

M. P. Zappe:

Russeting of Apples in 1928, Proceedings, 38th Annual Meeting, Conn. Pom. Society, 54. April, 1929.

Philip Garman and M. P. Zappe:

Control Studies on the Plum Curculio in Connecticut Orchards, Bull. 301, 68 pages, 8 plates, 12 figures. May, 1929.

R. B. Friend:

The Asiatic Beetle in Connecticut, Bull. 304, 84 pages, 4 plates. June, 1929.

Control of the Asiatic Beetle in Lawns, Bull. Imm. Inf. 62, 6 pages, 5 figures, 4,000 copies. March, 1929.

Control of Insects Affecting Truck Crops, Report Conn. Veg. Growers Assn. for 1928, 28.

R. C. Botsford:

Progress in Mosquito Elimination in Connecticut during 1928, Proceedings, 16th Annual Meeting N. J. Mosquito Exter. Assn., 120. July, 1929.

Neely Turner:

Tests for Oil Sprays, Proceedings, 38th Annual Meeting, Conn. Pom. Society, 49.

Variation in Resistance of Aphids to Toxic Sprays, Jour. Econ. Ent., 22: 323. April, 1929.

ENTOMOLOGICAL FEATURES OF 1929

The weather for the season of 1929 was unusual. After a rather mild winter without heavy snowfall or very low temperatures, the growing season started with cool and moist weather during April and May. Then higher temperature prevailed, but there was a shortage in precipitation for the months of June, July and September.

The rainfall for August was only slightly below normal, but nearly all of it fell in one shower on August 11.

In general, aphids were present and caused considerable damage. There was a marked spread of the European corn borer, and the Mexican bean beetle was discovered in the state for the first time. For the insect notes on the following pages, the writer is indebted to Mr. Zappe and Doctor Garman (fruit insects) and to Mr. A. E.

Wilkinson, Vegetable Specialist, extension department, Connecticut Agricultural College, Storrs (vegetable insects), for a part of the information.

Fruit Insects

As the apple crop was rather light, other things being equal, insect injury to the fruit was perhaps more conspicuous than in a year of heavy yield, and the percentages of perfect fruit were smaller.

Early in the season, eggs of the green apple aphid, *Aphis pomi* DeGeer, were abundant in apple orchards in New Haven County. After the eggs hatched, this species and the rosy apple aphid, *Anuraphis roseus* Baker, were rather abundant, but both Syrphid larvae and lady beetles were present and feeding upon them. It seemed probable that these predatory insects would control the aphids so that little or no aphid injury would result. But later in the season both kinds were very abundant in some orchards and the foliage was severely curled, though this happened too late to result in serious injury to the fruit crop. Mr. Zappe reported the rosy aphid as being present in apple orchards as follows: Bantam, May 13; Meriden, May 16; Branford and Guilford, May 29; Niantic, June 5; Farmington and Somers, June 6; East Hampton, June 10; Montville and Lebanon, June 12; Ledyard and Center Groton, June 13, and Waterbury, August 13. The writer observed a heavy infestation of rosy aphids on a large apple tree in a city yard in New Haven, June 18. Lady beetles were abundant. Specimens of the green apple aphid were received from Hamden, April 18.

The woolly apple aphid, *Eriosoma lanigerum* Hausman, was present in usual numbers, and specimens were received from Hamden, June 22.

The currant aphid, *Myzus ribis* Linn., and the cherry aphid, *Myzus cerasi* Fabr., are usually present each year throughout Connecticut. Specimens of the former were received from Woodbury and of the latter from New Haven on June 3.

The pear psylla, *Psylla pyricola* Forst., was reported as being prevalent and injurious in the eastern part of the state. According to Doctor Garman, this insect was fairly abundant in one orchard, but rather scarce in all other orchards visited in New Haven County on May 24. In Fairfield and New Haven Counties it seemed to be present in average abundance on July 24, though less abundant than in 1928.

The apple red bug, *Lygidea mendax* Reut., was absent in nearly all apple orchards throughout the state.

The San José scale, *Aspidiotus perniciosus* Comst., is now rather scarce and hard to find, but it was present in several nurseries and specimens were received from Waterbury, August 13.

The European fruit scale, *Lecanium corni* Bouché, and the rose scale, *Aulacaspis rosae* Bouché, were both received on blackberry canes from West Haven, on June 14.

The strawberry whitefly, *Trialeurodes packardi* Morrill, caused considerable injury in a strawberry field at Branford.

The pear midge, *Contarinia pyrivora* Riley, was present in certain orchards and caused the immature fruit to drop. Work of this insect was observed at Branford, May 29, and specimens were received from Mystic, June 10.

There was perhaps more than the usual amount of injury from the apple maggot or railroad worm, *Rhagoletis pomonella* Walsh. The best control is obtained by sprays of lead arsenate in July and early August and by the destruction of drops. Specimens were received from Plantsville, September 24; New Haven, September 28 and October 11, and from Vernon, November 6.

In Wallingford early in the season, slight injury was reported to fruit from green fruit worms, *Xylina antennata* Walker.

The Eastern tent caterpillar, *Malacosoma americana* Fabr., has at last become scarce over a greater portion of the state. A few nests were observed in Litchfield County, where several successive freezes killed the cherry leaves and the caterpillars died. These nests failed to increase in size and they did not contain living caterpillars. This insect may be considered as having now reached its minimum. In a few years it will probably again become prevalent.

Larvae of one of the lappet moths, *Tolype velleda* Stoll., feeding upon apple foliage were received from Woodmont, August 2, and from Waterbury, August 13. This insect is never sufficiently abundant to be considered as a pest.

Occasionally apple trees are found with large burrows of the leopard moth, *Zeuzera pyrina* Linn., in trunk or branches. Specimens of such injury were received from South Manchester, May 31, and from Milford, August 29.

The fall cankerworm, *Alsophila pometaria* Harris, though less prevalent than last year, was present and caused some damage in certain localities. This was true in portions of New Haven and New London Counties, where trees were stripped in 1928. Specimens were received from Clintonville, May 16, and from East Hampton, June 10.

The bud moth, *Tmetocera ocellana* Schiff., caused some injury in the vicinity of Litchfield, in May, by devouring the buds on young trees. It was also reported from Kensington, May 16. There was little injury in other portions of the state.

Considerable surface injury to stored apples by the red banded leaf roller, *Eulia velutinana* Walker, was noticed about November 1, in New Canaan and Wilton. This insect was reported as being rather abundant in Fairfield County.

Rather more than the usual proportion of fruit was injured by the codling moth, *Carpocapsa pomonella* Linn. Not only was this true of the first brood but there was also considerable side injury by the larvae of the second brood. On the whole, this insect was well controlled where the trees were properly sprayed.

One of the most destructive insects of the year is the Oriental peach moth, *Laspeyresia molesta* Busck, which was prevalent in the central portion of the state and caused serious injury in some of the peach orchards.

In certain orchards in Wallingford, it caused less damage than five years ago, but in other orchards not many miles distant between 75 and 100 per cent of the peaches were wormy at harvest time. Quinces were also ruined. Twig injury to peach trees was prevalent in June and July in Hartford and New Haven Counties.

Unusually abundant everywhere in 1929 was the plum curculio, *Conotrachelus nenuphar* Herbst., which injured a large proportion of the fruit in apple orchards, especially near woodlands. Mr. Zappe reports it as being very abundant on apple in the following localities: Niantic, June 5; Somers, June 6; East Hampton, June 10; Ledyard, June 13; a few at Lebanon, June 12. Reported as present at South Windsor, and Farmington, June 6; Glastonbury and Montville, June 12; Burlington and Unionville, June 26; Waterbury, August 13; Collinsville, August 26, and Norwalk, August 27. It was reported on peach from Putnam, July 26, and Collinsville, August 26.

The pear leaf blister mite, *Eriophyes pyri* Pag., is usually present to some extent on pear and apple. Specimens were received on pear from Glastonbury, May 22.

The European red mite, *Paratetranychus pilosus* C. and F., was probably less prevalent than in 1928, though moderately abundant in apple orchards in Hartford and New Haven Counties. There were many eggs in orchards in New Haven County in March, and there was a rather heavy infestation in Kensington in May. Mr. A. T. Henry, of Wallingford, reports few eggs present this winter, 1929-1930, but Prof. J. A. Manter of the Connecticut Agricultural College at Storrs writes that the eggs are abundant there.

Vegetable Insects

Perhaps the most important item to include under this heading is the discovery that the Mexican bean beetle, *Epilachna corrupta* Muls., has appeared in Connecticut. It was first discovered and reported by Dr. E. P. Felt, and afterwards found to be distributed throughout the western half of the state. A more complete account is given in another part of this report, page 581.

Flea beetles, *Epitrix cucumeris* Harris, were very abundant and caused injury to crops of potato, tomato, egg-plant, cucumber, early squash, melon and tobacco. Sprays of pyrethrum-soap preparations have been successfully used as a remedy by some growers.

The striped beetle, *Diabrotica vittata* Fabr., was very abundant at the Station farm at Mount Carmel.

The Colorado potato beetle, *Leptinotarsa decemlineata* Say., was unusually abundant in most localities throughout the state.

The asparagus beetle, *Crioceris asparagi* Linn., was present in the usual abundance. Specimens were received from Rockville, May 28, and from West Haven, July 30.

The squash lady beetle, *Epilachna borealis* Fabr., was received from Higganum, July 15.

The margined blister beetle, *Epicauta marginata* Fabr., was reported as injuring Swiss chard at Hamden, July 23.

In general, cutworms were less troublesome than usual at the time when cutworms usually cause injury, but in late June and early July, certain kinds, especially a black cutworm, appeared in certain fields in New Haven County and caused considerable injury to sweet corn and potatoes. Such injury was reported from Meriden, Yalesville, Wallingford, Foxon, Branford, Highwood, Woodbridge, Woodmont, Orange, and North Haven. Though specimens were collected, we were unable to rear the adults.

The squash vine borer, *Melittia satyriniformis* Hübner, was very abundant at the Station farm at Mount Carmel.

The stalk borer, *Papaipema nitela* Guen., was exceedingly abundant throughout the state and in the stems of various plants. Specimens were received in corn from Bethlehem, Cheshire, Durham, Hamden, New Haven, Shelton, Wallingford, Waterford, Westport and Winsted; in tomato, from Cheshire, and in beans from West Haven.

The corn ear worm, *Heliothis obsoleta* Fabr., was more abundant than usual and was present over a longer period.

The first specimens were received on July 15, and from then until frost, it was observed. Specimens were received from Hamden, Hartford, New Haven, Plainville, Plantsville, West Suffield and Woodbridge. It was also reported from Niantic.

The zebra caterpillar, *Mamestra picta* Harr., feeding upon the shoots of asparagus, was received from Meriden, June 10.

The cabbage worm, *Pontia rapae,* Linn., and the cabbage looper, *Autographa brassicae* Riley, were present in usual abundance. The diamond-back caterpillar, *Plutella maculipennis* Curtis, was unusually abundant and was present in nearly every field where cabbages were grown.

The European corn borer, *Pyrausta nubilalis* Hübn., has spread rapidly in 1929, and 38 new towns have been placed under

quarantine. This insect will be discussed in greater detail in another part of this report. Larvae were received from Uncasville, October 7.

A green noctuid larva eating into a green pea pod was received from West Hartford, June 3.

The army worm, *Heliophila unipuncta* Haw., was brought to the Station, June 24, from Woodmont, where it was injuring corn in connection with cutworms.

The cabbage maggot, *Hylemyia brassicae* Bouché, was everywhere abundant throughout the state and untreated plants were ruined. Plants kept treated with corrosive sublimate after setting produced a good crop.

No reports were received of injury by the carrot rust fly, *Psila rosae* Fabr., and there was little or no damage from the spinach leaf miner, *Pegomyia hyoscyami* Panz.

The squash bug, *Anasa tristis* DeGeer, was present in usual numbers. Specimens were received from Higganum, July 15.

Aphids caused great injury to potato, tomato, egg-plant and turnip during midsummer and later. Early in the season, though aphids were present, Syrphid larvae and lady beetles were abundant and were expected to keep the aphids in check.

Shade and Forest Tree Insects

The arborvitae leaf miner, *Argyresthia thuiella* Pack., continues to injure trees in certain portions of Connecticut. Specimens were received from Old Lyme, May 15, and from Riverside, May 18.

The larch case bearer, *Coleophora laricella* Hübner, was received from Middlebury, May 18; Norfolk, June 5, and from Storrs, August 5. It was reported from Greenwich by Dr. E. P. Felt.

The European pine shoot moth, *Rhyacionia buoliana* Schiff., is becoming rather common on Scotch and red pine in Fairfield County. Specimens on red pine were received from Darien, August 27, and it was found on red pine in Hamden and vicinity by Doctor Friend.

The white oak leaf miner, *Lithocolletes hamadryadella* Clemens, was received from South Manchester, August 5.

The spiny elm caterpillar, *Euvanessa antiopa* Linn., was received from Fairfield, June 4.

The fall webworm, *Hyphantria cunea* Dru., was reported by Mr. Zappe as being very abundant in the western half of the state.

A small moth, *Nepticula sericopeza* Zell., was reared from the petioles of Norway maple by Doctor Felt, of Stamford. The larva is a leaf miner in the stems and causes many leaves to drop.

The bronze birch borer, *Agrilus anxius* Gory, continues to kill

white birch trees on private grounds. These trees are chiefly the cut-leaf form of the European white birch. Specimens were received from South Glastonbury, May 22.

The white pine weevil, *Pissodes strobi* Peck, was unusually abundant throughout the state.

The imported willow leaf beetle, *Plagiodera versicolora* Laich., has skeletonized many smooth-leaf willows throughout Connecticut. Specimens were received from Wallingford, June 6, and from Southport, July 22.

A small Scolytid beetle, *Pityogenes hopkinsi* Swains., was found breeding under the bark of some dying white pines in a flooded area in Middlebury, May 18.

The imported sawfly birch leaf miner, *Fenusa pumila* Klug., which has spread throughout the state, causes an unsightly appearance to small paper and gray birches often planted for ornamental trees. Specimens were received from Bridgeport, June 10, and from Bantam, August 22.

The larch sawfly, *Lygaeonematus erichsoni* Hart., was received from Gilead, July 2.

Pine sawflies were rather common in 1929. One species, *Neodiprion pinetum* Norton, was received from Portland, July 18, and from New Haven, August 29.

The catalpa leaf miner, probably *Agromyza clara* Mel., has become rather abundant and was found in 31 nurseries, chiefly on *Catalpa bungei.* Specimens were received from Manchester, September 12.

Aphids were rather abundant on trees in 1929. One species, probably *Dilachnus strobi* Fitch, on white pine, was received from Suffield, October 8. The cockscomb elm gall, *Colopha ulmicola* Fitch, was received from Stamford, July 5. The beech woolly aphid, *Prociphilus imbricator* Fitch, which is common on the under sides of the leaves of purple beech, was received from New Haven, June 10. The pine bark aphid, *Adelges pinicorticis* Fitch, is common on the needles and bark of white pine trees everywhere. Specimens were received from New Haven, May 29 and June 3, and from Waterbury July 1. The spruce gall aphid, *Adelges abietis* Linn., is becoming increasingly common on Norway and white spruce and was found in 85 nurseries. Specimens were received from Riverside, May 28; Woodbury, July 22; Branford, September 16, and Greenfield Hill, Fairfield, November 18. The blue spruce gall aphid, *Gillettea cooleyi* Gill., is also on the increase and was found in 62 nurseries.

The oyster-shell scale, *Lepidosaphes ulmi* Linn., continues to be one of the most prevalent of all insect pests. It was found in 78 nurseries in 1929, and was received on willow from New Haven, and on poplar from Greenfield Hill, Fairfield.

The pine leaf scale, *Chionaspis pinifoliae* Fitch, is common on

young pine trees growing in protected situations. Specimens on red pine were received from Old Lyme.

The tulip tree scale, *Toumeyella liriodendri* Gmel., is fairly abundant on tulip tree and magnolia throughout the state. During the season, specimens of this scale were received from Torrington and Bridgeport, and it was reported by Doctor Felt as being locally abundant around Stamford.

Maple trees, especially silver maple, are often attacked by the terrapin scale, *Lecanium nigrofasciatum* Perg. This scale occurs on the small twigs. Specimens were received from Wallingford, July 16.

There are several species of oak gall scales in Connecticut that are globular and attached to the twigs. Specimens identified as *Kermes galliformis* Riley, on pin oak, were received from Wallingford, July 16, and similar gall scales were very abundant on black oak trees in East Rock Park, New Haven.

The golden oak scale, *Asterolecanium variolosum* Ratz., was reported on April 25, as being very abundant on native chestnut oak around New Haven.

The cottony maple scale, *Pulvinaria vitis* Linn., was reported by Dr. E. P. Felt as being locally very abundant in the vicinity of Stamford. It occurs chiefly on silver maple.

Another scale, *Leucaspis japonica* Ckll., is reported by Doctor Felt to have injured Norway and soft maples in Greenwich.

During the past few years there has been much injury to coniferous trees from the attacks of the spruce mite, *Paratetranychus ununguis* Jacobi. Possibly spruce is more commonly injured than other kinds, but occasionally it also attacks pine, arborvitae, and other trees. Specimens of this mite were received from Bristol, June 13.

Insects Attacking Ornamental Shrubs and Vines

A leaf roller, *Archips rosana* Linn., on privet was rather common around New Haven during the season. Specimens were received from New Haven, May 28, and the insect was noticed on several hedges.

The box leaf miner, *Monarthropalpus buxi* Labou., is now present in several localities in Connecticut. Specimens were received from New Canaan, June 1.

The abbot sphinx, *Sphecodina abbotii* Swains., was prevalent on Virginia Creeper and grape throughout the state. Specimens were received from New Haven, July 9; Shelton, July 16; Granby, July 27, and Clinton, July 29.

A mite, *Phyllocoptes schlectendali* Nalepa, was found on the writer's privet hedge in May. Specimens were also received from New Haven, June 13. This mite curls the leaves on the new tips but on trimming the hedge, most of these tips are clipped off.

On the writer's hedge, evidence of the pest wholly disappeared later in the season.

The black vine weevil, *Brachyrhinus sulcatus* Fabr., and the strawberry weevil, *Brachyrhinus ovatus* Linn., are rather abundant and cause injury to young conifers by eating the bark of the roots. Larvae of the former were received from Norwalk, and the latter from Cromwell.

The euonymus scale, *Chionaspis euonymi* Comst., is reported by Dr. E. P. Felt as being locally abundant around Stamford.

The white scale or West Indian peach scale, *Aulacaspis pentagona* Targ.-Tozz., has for a number of years infested privet, flowering peach, *Catalpa bungei,* and other trees and shrubs in Fairfield County. Doctor Felt reports that a scale, probably this species, has been injurious at Greenwich.

Insects Attacking Flowers and Greenhouse Plants

The verbena bud worm, *Olethreutes hebesana* Walker, was received July 23 from Durham, where considerable injury was caused to plants in a verbena bed.

The iris root borer, *Macronoctua onusta* Grote, was received from New Haven, August 27.

The variegated cutworm, *Peridroma margaritosa* Haw., var. *saucia* Hübn., was very abundant and injured various plants in greenhouses during April.

The greenhouse leaf tyer, *Phlyctaenia ferrugalis* Hübn., was reported as causing considerable injury to plants in greenhouses in Shelton, May 24.

The chrysanthemum gall midge, *Diarthronomyia hypogaea* Loew, was received from Norwich, July 19, where it caused injury in a greenhouse.

The columbine leaf miner, *Phytomyza aquilegiae* Hardy, was present in many gardens in 1929. Specimens were received from Bridgeport, August 27.

The tarnished plant bug, *Lygus pratensis* Linn., causes considerable injury by sucking the sap from various kinds of plants, especially dahlia and aster. Specimens were received from Thomaston, July 13; Naugatuck, July 29, and from Harwinton, August 3.

The four-lined leaf-bug, *Poecilocapsus lineatus* Fabr., is always present in gardens and injures the tender terminal leaves by sucking out the sap, which results in circular transparent spots. Specimens were received from Hamden, June 12, and from New Haven, July 29.

The cottony cushion scale or fluted scale, *Icerya purchasi* Mask., on acacia in greenhouse, was received from Norwalk, September 5.

The common mealy bug, *Pseudococcus citri* Risso., was received on Impatiens, from Hartford, September 17.

The margined blister beetle, *Epicauta marginata* Fabr., was received from West Haven, July 29, where it was feeding upon the leaves of a variegated foliage plant.

Fuller's rose beetle, *Pantomorus godmani* Crotch, was brought to the Station on September 5 from a greenhouse in Norwalk, where it was feeding on the blossoms of acacia.

The bulb mite, *Rhizoglyphus hyacinthus* Banks, is commonly injurious to bulbs and was received from Ridgefield, July 25.

The garden or greenhouse red spider, *Tetranychus bimaculatus* Harv., is very common on phlox, and specimens were received from Old Saybrook, August 7.

The cyclamen mite, *Tarsonemus pallidus* Banks, is a troublesome pest of cyclamen, larkspur, chrysanthemum, and other plants. Specimens were received from Norwalk and Branford.

Field and Lawn Insects

The Asiatic beetle, *Anomala orientalis* Waterhouse, was found in a small private lawn in Bridgeport, May 17 and 25. This is the first infestation discovered in Connecticut outside of New Haven and West Haven. On July 23 an adult was received from New Haven, outside of the former infested area.

White grubs, *Phyllophaga* sp., were responsible for considerable injury to lawns in Connecticut in 1929. Specimens of grubs in soil were received from Greenwich, April 25; from East Hampton, May 1; from Salisbury, August 15, and from Stafford Springs, September 11. Lawns in Glastonbury were injured and reports received September 18. The grubs from Salisbury and Stafford Springs were nearly all *Phyllophaga fusca* Fröh., according to Doctor Friend. Two adults of *P. gracilis* Burm. were received from Clinton, August 26.

The chinch bug, *Blissus leucopterus* Say., is responsible for killing the grass in a small spot on a lawn in Hartford. Adults and nymphs were very abundant in this spot. Specimens were received October 1.

Wireworms caused some injury to corn at North Haven. Mr. Walden visited the field July 6 and collected material which he identified as *Melanotus* sp., probably *communis* Gyll.

Tobacco plants were seriously injured by flea beetles, *Epitrix cucumeris* Harris, at Windsor in July.

Household Insects

The dog flea, *Ctenocephalus canis* Curtis, often infests dwelling houses and bites human beings. It was seemingly more abundant than usual in 1929. Specimens were received from Hartford, August 16, and from New Haven, August 19.

Specimens of the carpet beetle, *Anthrenus scrophulariae* Linn.,

were received from Norwalk, July 1, and from West Haven, November 30.

The saw-toothed grain beetle, *Oryzaephilus surinamensis* Linn., which feeds upon cereals and stored grains, was received from Southington, August 2, and from Norwich, August 24.

One species of "silver-fish" or "fish-moth," *Thermobia domestica* Pack., was received from Meriden, October 16, and a small spider-beetle, *Ptinus fur* Linn., from Hartford, November 30. The former injures books by feeding upon the paste used on the bindings and the latter damages wool, fur, clothing, stuffed furniture, seeds and other plant products.

Miscellaneous Insects

An adult of the northern mole cricket, *Gryllotalpa hexadactyla* Perty, was received from Hamden, August 29.

The Japanese beetle, *Popillia japonica* Newman, was somewhat more abundant in Stamford, Bridgeport, New Haven, Hartford and New London, than in 1928. Though nearly all of the cities and larger villages were scouted in 1929 the only new locality for this insect is Willimantic. One specimen was received from Hartford, August 27.

Grubs of the Asiatic garden beetle, *Aserica castanea* Arrow, were discovered in soil in the towns of New Canaan, Fairfield, Ridgefield, Mansfield, Cromwell and Manchester. Adults were collected in New Haven and New London.

The brilliant green-gold beetle, *Chrysochus auratus* Fabr., was thought to be the Japanese beetle, and specimens were received from Warren, July 10; Avon, July 30, and from Woodbury, August 12. This beetle feeds upon milkweed and dogbane, and is much smaller than the Japanese beetle.

The large aquatic bug, *Benacus griseus* Say., leaves the water and is attracted to electric lights. Adult specimens were received from New Haven, June 17, and from Norwalk, July 12.

The leather beetle, *Dermestes vulpinus* Fabr., was received September 30, from Danbury, where it was feeding upon stored rabbit hides.

The cherry tent-maker, *Archips cerasivorana* Fitch, was very abundant on choke-cherry sprouts in Cheshire.

One of the powder-post beetles, *Lyctus opaculus* LeC., was reported in May as injuring the ash wood of an ice box that had been used in the family eight years.

Convention of Entomological Workers

The sixth annual convention of entomologists working in Connecticut was held in the Community House at the Connecticut Agricultural College, Storrs, on Friday, October 25, 1929. These

meetings are for the purpose of bringing together the research men, teachers, field men and amateur collectors in the state, and entomologists in the adjacent states are invited. The program of the 1929 conference was planned to include subjects of vital importance to Connecticut, and several Federal men who are working in coöperation with state men on control projects were asked to present papers. The following entomologists from outside Connecticut presented papers: A. F. Burgess, Melrose Highlands, Mass.; H. L. McIntyre, Albany, N. Y.; L. H. Worthley, Boston, Mass.; C. H. Hadley, Camden, N. J.; and Harold C. Hallock, Westbury, N. Y. About 60 attended the conference. Luncheon was served in the College dining hall. The following program was carried out without a single substitution:

Program

A. M.

10:30 Greeting, Dr. Geo. A. Works, President, Conn. Agr. College, Storrs
Prof. G. H. Lampson, Jr., Conn. Agr. College, Storrs

10:45 Present-Day Opportunities in Entomology,
Mr. A. F. Burgess, Gipsy Moth Control, Melrose Highlands, Mass.

11:15 Chief Entomological Events of the Season in Connecticut.
Dr. W. E. Britton, State Entomologist, Agr. Expt. Sta., New Haven

11:30 Survey of Gipsy Moth Conditions,
Mr. H. L. McIntyre, Department of Conservation, Albany, N. Y.

12:00 Shade Tree Insects in 1929,
Dr. E. P. Felt and S. W. Bromley, Stamford

12:15 Present Status of the European Corn Borer in the United States,
Mr. L. H. Worthley, Corn Borer Control, Boston, Mass.

P. M.

1:00 Luncheon

2:00 Inspection of new Entomological laboratories, Beach Hall

2:30 The Japanese Beetle in the United States,
Mr. C. H. Hadley, Japanese Beetle Control, Camden, N. J.

3:00 Notes on Biology and Methods of Control of *Aserica castanea*,
Mr. Harold C. Hallock, Bur. of Entomology, Westbury, N. Y.

3:30 Some Aspects of Asiatic Beetle Control,
Dr. R. B. Friend, Asst. Ent., Agr. Expt. Sta., New Haven

3:45 An Attempt to Rear Parasites for the Control of the Oriental Peach Moth in Connecticut,
Dr. Philip Garman, Asst. Ent., Agr. Expt. Sta., New Haven

4:15 Katydids as Thermometers,
Prof. J. A. Manter, Agr. College, Storrs

4:30 Insecticide Studies at the Bartlett Research Laboratories in 1929,
Mr. Stanley W. Bromley and Dr. E. P. Felt, Stamford

The following were present: John T. Ashworth, Danielson; R. C. Botsford, New Haven; A. I. Bourne, Amherst, Mass.; W. E. Britton, New Haven; S. W. Bromley, Stamford; A. F. Burgess, Melrose Highlands, Mass.; T. M. Cannon, Norwalk; O. B. Cooke, Danielson; S. S. Crossman, Melrose Highlands, Mass.; E. B. Davidson, Hartford; R. M. De Coursey, Storrs; George B. Durham, Storrs; F. S. Eaton, New Haven; Gustavus

Eliot, New Haven; E. P. Felt, Stamford; B. J. Fitzsimmons, Jr., Hartford; R. B. Friend, New Haven; C. W. Frink, Brooklyn; Philip Garman, New Haven; G. H. Geissler, Storrs; L. E. Gibson, Melrose, Mass.; Robert D. Glasgow, Albany, N. Y.; C. H. Hadley, Camden, N. J.; Harold C. Hallock, Westbury, N. Y.; Kenneth N. Hanks, Storrs; Harry C. Helliwell, Shelton; S. P. Hollister, Storrs; Harry Horovitz, Providence, R. I.; C. E. Jennings, Storrs; J. P. Johnson, Shelton; T. H. Jones, Melrose Highlands, Mass.; J. W. Kelley, Jr., Shelton; J. F. Keough, Willimantic; Nathan Koenig, Storrs; G. H. Lampson, Jr., Storrs; Alvin J. Lannon, Providence, R. I.; J. W. Longo, Danielson; J. A. Manter, Storrs; J. B. Marshall, Boston, Mass.; B. W. McFarland, New Haven; H. L. McIntyre, Albany, N. Y.; A. E. Moss, Storrs; G. H. Pallman, New Haven; R. H. Patch, Storrs; Saul Phillips, Albany, N. Y.; Chester J. Poliks, Storrs; K. A. Salman, Amherst, Mass.; A. F. Schulz, Storrs; John C. Schread, New Haven; R. A. Spencer, Bloomfield; A. E. Stene, Kingston, R. I.; Dewey G. Steele, Storrs; J. F. Townsend, Neely Turner, B. H. Walden and B. H. Wilford, New Haven; R. H. Wallace and Geo. A. Works, Storrs; L. H. Worthley, Boston, Mass.; M. P. Zappe, New Haven.

INSPECTION OF NURSERIES IN 1929

W. E. Britton and M. P. Zappe

In 1929, the regular annual inspection of nurseries, as provided in Chapter 265, Public Acts of 1925, was commenced July 1, and completed October 1, except for a few new nurseries that were registered late in the season. This work was in charge of Mr. Zappe, who was assisted by Messrs. A. F. Clark, J. G. Conklin and H. B. Bender. In a few special cases, assistance was rendered by Mr. Stoddard, Mr. Walden and Doctor Britton.

Mr. Bender is a member of the Botany Department and was employed on this work for three months in order to give particular attention to such plant diseases as might be present in the nurseries.

As in former seasons the gipsy moth scouts were instructed to search with particular care in and around all nurseries within the infested area and to report to the office at once in case any gipsy moth eggs were discovered in a nursery or in close proximity to a nursery during 1929. Also as in preceding years the pine blister rust scouts under Mr. J. E. Riley, Jr., examined all nurseries where the presence of the pine-currant blister rust was reported by the nursery inspectors.

In general, the nurseries were in rather better condition than in 1928, due to the fact that they had been given better cultivation and to the dry season, which was not favorable to the growth of weeds. Plant diseases were somewhat less abundant than in 1928, but some insects were quite as prevalent or more so. Aphids were generally abundant. Spruce gall aphids, both *Adelges abietis* and *Gillettea cooleyi,* were found in a larger number of nurseries than ever before. This is due partly because the number of nurseries

is greater than ever before and partly to a seeming increase in the prevalence of these insects. Spraying during the first half of April with a contact spray to kill the over-wintering females has been practiced in a few nurseries, and will need to be practiced much more extensively if this pest is to be kept in control.

In 13 nurseries no pests were found. Following is a list of the insects and plant diseases found in nurseries in the annual inspection of 1929 and the number of nurseries infested by each:

PESTS FOUND IN NURSERIES IN 1929
Number of nurseries uninfested, 13

INSECTS

Name	No. nurseries
Aleyrodes	25
Anisota rubicunda	1
stigma	1
Aphids, apple, green	55
woolly	64
on Bechtel's crab	6
beech (woolly)	2
birch	8
Celastrus	1
cherry	4
chestnut	1
chrysanthemum	1
cotoneaster	1
Crataegus	23
currant	2
Cytisus	1
elm	5
elm (woolly)	10
Euonymus	2
fir	2
flowering crab	10
forsythia	1
hollyhock	1
larch (woolly)	3
Lonicera	1
maple	5
mountain ash	12
oak	1
pear	4
red pine	1
white pine	1
white pine (woolly bark)	75
plum	3
poplar	1
poplar leaf stem gall	1
Prunus pissardi	3
rose	4
spirea	3
spruce	3
Adelges abietis	85
Gillettea cooleyi	62
sumac	1
Aphids on viburnum	4
weigelia	1
willow	7
Apple and thorn skeletonizer	20
Apple case bearer	2
Borer, apple (*Zeuzera*)	2
Crataegus	1
currant	1
lilac	6
linden	2
maple	1
oak (*Agrilus*)	1
peach	6
rose (*Agrilus*)	2
white pine weevil	37
willow (*Cryptorhynchus*)	6
(*Saperda*)	1
Brachyrhinus ovatus	2
sulcatus	2
Bugs on ash (Capsids)	1
Cutworms	1
Elm case bearer	9
Elm leaf beetle	9
European pine shoot moth	7
Fall webworm	26
Flea beetle, viburnum	1
Crepidodera helxines	3
Epitrix cucumeris	2
Galls, elm (cockscomb)	11
linden	2
oak	5
tulip tree leaf	7
willow	1
Io larvae	3
Juniper webworm	12
Lace bugs, birch	1
juglans	1
kalmia	1
quince	1
rhododendron	41
sycamore	2

Name	No. nurseries
Leaf hoppers, apple	12
ash	1
Crataegus	1
Helenium	1
Japanese maple	1
maple	1
mountain ash	2
poplar	2
rose	1
weigelia	1
wisteria	1
Leaf-miner in apple	12
arborvitae	2
beech	4
birch (*Fenusa pumila*)	63
blueberry	1
boxwood	1
catalpa	31
chestnut	1
columbine	22
elm	16
grape	1
hydrangea	1
lilac	2
linden	2
locust	12
magnolia	1
maple	1
oak	8
peach	3
philadelphus	1
poplar	1
quince	1
sycamore	5
tulip tree	2
Leaf roller, spiræa	2
privet	1
Leaf tylers, sycamore	2
viburnum	1
Luna moth larvae	1
Melalopha inclusa	2
Midges on catalpa	1
Mites, European red	8
pear leaf blister	32
Mite galls on Cephalanthus	1
Exochorda	10
Mites on silver maple	16
birch	1
Delphinium	4
elm	2
juglans	1
juniper	1
linden	3
mountain ash	1
oak	5
spruce	8
willow	3
Oriental peach moth	48
Ormenis pruinosa	3
Papaipema larvae	2
Pear psylla	2
Pear slug	20
Sawfly larvae on arborvitae	3
birch	1
dogwood	4
mountain ash	1
pine	4
Scale, elm	21
oak gall	2
oyster-shell	78
pine leaf	13
rose	10
San José	22
scurfy	1
tulip tree	2
West Indian peach	5
Slug caterpillars	1
Sphinx larvae	1
Spiny elm caterpillars	1
Spittle bugs on arborvitae	1
forsythia	1
juniper	3
lilac	1
pine	1
weigelia	1
willow	1
Tussock moth eggs	2
Tussock moth larvae	2
Willow leaf beetle, *Plagiodera versicolora*	16
White flies	1
Yellow necked caterpillars	3
Zebra caterpillars	1

PLANT DISEASES

Name	No. nurseries
Anthracnose, cherry	9
currant	8
hollyhock	1
Anthracnose, poplar	5
sycamore	3
Bacterial leafspot, larkspur	46

Name	No. nurseries
Bacterial leafspot, peach	1
Black knot	6
Black rot, apple	24
Botrytus, paeony	16
Brown rot	
flowering almond	11
peach	2
plum	2
quince	1
Canker, poplar	37
Chestnut blight	1
Chlorosis silver maple	1
Crown gall	10
Entomosporium, quince	11
Exobasidium, honeysuckle	3
Symphoricarpos	2
Fire blight	1
Gnomonia ulmi	9
Leaf spot on Andromeda	8
Aristolochia	3
ash	2
Azalea	2
barberry	8
birch	1
box elder	5
boxwood	7
carya	1
catalpa	79
cherry	2
currant	1
dogwood	1
English ivy	2
grape	7
hollyhock	6
horse chestnut	34
iris	62
Japanese maple	55
juglans	1
kalmia	25
larkspur	1
lilac	2
mahonia	1
maple	57
mountain ash	21
oak	1
paeony	1
Leafspot on peach	1
phlox	74
quince	6
rhododendron	66
rhubarb	21
rose	98
strawberry	28
sycamore	1
yucca	2
Maple tar spot	16
Marsonia juglandis	10
Mildew on ampelopsis	1
apple	16
catalpa	30
golden glow	1
grape	5
Helianthus	1
juglans	1
larkspur	8
lilac	34
mountain ash	1
oak	1
phlox	50
raspberry	1
rose	78
solidago	1
symphoricarpos	1
sycamore	1
Mosaic on apple	23
raspberry	7
Raspberry cane blight	2
Rust on apple	46
ash	5
Bechtel's crab	43
Crataegus	19
hollyhock	7
juniper	11
pear	2
quince	7
Scab on apple	57
pear	2
willow	1
White pine blister rust on pine	2
on Ribes	7
Yellowing of lilacs	20

An examination of the preceding list will show that among the insects, the spruce gall aphid, *Adelges abietis,* as was the case in the last two years, was found in more nurseries (85) than any other insect, followed by oyster-shell scale (78), woolly pine bark aphids (75), apple woolly aphids (64), birch leaf miner, *Fenusa pumila* (63), blue spruce gall aphid, *Gillettea cooleyi* (62), green apple aphid (55), Oriental peach moth (48), rhododendron lace

bugs (41), white pine weevil (37) pear leaf blister mite (32), catalpa leaf miners (31), fall webworm (26), aleyrodes (25), aphids on crataegus (23), columbine leaf miner (22), San José scale (22), elm scale (21), apple and thorn skeletonizer (20), pear slug (20), *Plagiodera versicolora* (16), mite galls on silver maple (16), pine leaf scale (13), aphids on mountain ash (12), juniper webworm (12), leaf hoppers on apple (12), leaf miners on apple (12), leaf miners on locust (12), elm cockscomb gall (11), aphids on flowering crab-apple (10), mite galls on Exochorda (10), rose scale (10), woolly elm aphid (10).

Among the plant diseases found in nurseries in 1929, leaf spot of rose heads the list (98), followed by leaf spot of catalpa (79), mildew of rose (78), leaf spot of phlox (74), leaf spot of rhododendron (66), leaf spot of iris (62), apple scab (57), leaf spot of maple (57), leaf spot of Japanese maple (55), mildew of phlox (50), apple rust (46), bacterial leaf spot of larkspur (46), rust of Bechtel's crab (43), poplar canker (37), leaf spot of horse-chestnut (34), mildew of lilac (34), mildew of catalpa (30), leaf spot of strawberry (28), leaf spot of Kalmia (25), black rot of apple (24), mosaic of apple (23), leaf spot of mountain ash (21), leaf spot of rhubarb (21), yellowing of lilacs (20), tar spot of maple (16), mildew of apple (16), *Entomosporium* of quince (11), brown rot of flowering almond (11), rust of juniper (11), *Marsonia juglandis* (10), and crown gall (10).

NINE-YEAR RECORD OF CERTAIN NURSERY PESTS

	1921	1922	1923	1924	1925	1926	1927	1928	1929
Oyster-shell scale	36	44	42	44	38	39	45	57	78
San José scale	28	19	20	32	32	19	16	30	22
Spruce gall aphids[1]	31	21	28	40	27	42	82	120	147
White pine weevil	1	19	17	5	5	8	17	19	37
Apple and thorn skeletonizer		1	18	2	8	9	22	49	20
Poplar canker	21	31	34	25	34	32	39	35	37
Pine blister rust (on *Ribes*)	2	9	6	8	7	9	9	5	7
Nurseries uninfested	36	36	32	33	34	46	37	18	13
Number of nurseries	94	101	106	116	151	162	191	228	266

It should be understood that the figures in the preceding table are not strictly comparable because of the greater number of nurseries since the new law went into effect in 1925. Thus though the number of infested nurseries is greater, the actual percentage may be considerably less.

Number and Size of Nurseries

The number of nurseries in Connecticut has increased each year. The list for 1927 contained 191 names. The list for 1928 contains 228 names and for 1929, 266 names. Of the 266 separate nurseries in the state, a classification on account of size may be made as follows:

[1] Includes both *Adelges abietis* and *Gillettea cooleyi*.

Nurseries containing	50 acres or more	16
" "	between 10 and 50 acres	37
" "	" 5 and 10 "	29
" "	" 2 and 5 "	64
" "	1 acre or less	120
		266

In 1929, 288 nursery inspections were made. The list of nursery firms receiving certificates contains 266 names; 22 being

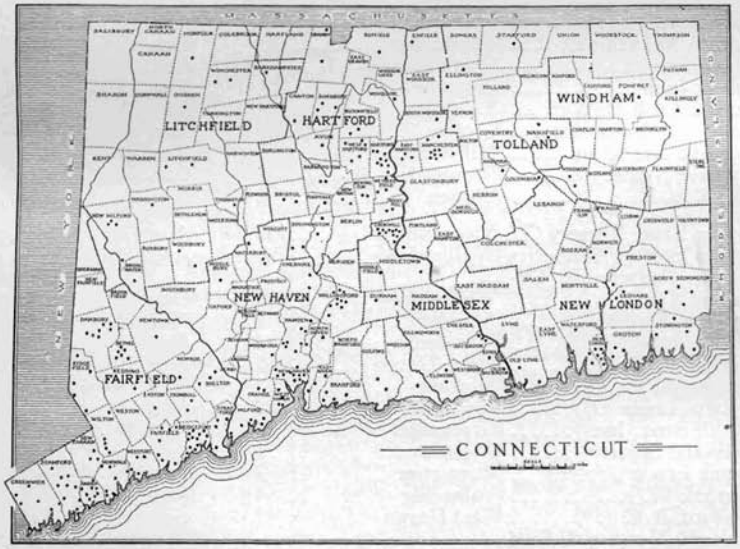

FIGURE 44. Map of Connecticut showing location of nurseries.

new nurseries registered in the winter that were inspected twice, once in the spring and again in the fall.

From the owners of three nurseries failing to register before July 1, as provided in Section 2, Chapter 265, Public Acts of 1925, $40 was collected to cover the cost of inspection, and this amount was sent to the State Treasurer on January 8, 1930. This cost of inspection would have been greater had it been necessary to make special trips from New Haven to inspect each nursery but when men are working in the vicinity of several nurseries the expense of travel is divided between the nurseries.

The total area of nurseries in Connecticut in 1929 is equivalent to about 3,157 acres. The figures were taken for the most part from the estimates of the owners and managers as given on the registration cards, supplemented by the inspector. Each nursery

of less than an acre in extent is listed as one acre and where fractions are given, the next whole number is recorded. Certified nurseries now number 266; 49 new ones have been added within the year, and 13 have discontinued the business. Sixteen on last year's list are now listed under different firm names. The location of these 266 nurseries is shown on the map in Figure 44. The list of nursery firms granted certificates in 1929 is as follows:

CONNECTICUT NURSERY FIRMS CERTIFIED IN 1929

Name of firm	Address	Acreage	Certificate issued	No. of certificate
Alius, Adolf	Stamford	1	Aug. 26	894
Aldrich, Miss Inie E.	Thomaston	5	Oct. 29	1,012
Allen, Henry L.	North Stonington	1	Aug. 5	831
Amato, John	Cromwell	1	Aug. 15	867
Amelunxen & DeWyn	Yalesville	4	July 31	802
Ampelopsis Nurseries	Groton	1	Aug. 5	828
Arawana Nurseries	Milford	1	Nov. 26	1,030
Artistree Nursery	Branford	1	Oct. 24	1,005
Austin, M. E.	Clinton	2	Sept. 21	971
Barnes Bros. Nursery Co.	Yalesville	150	Aug. 2	820
Barnes Eastern Nurseries	Wallingford	10	Aug. 1	819
Barnes Nursery & Orchard Co.	Wallingford	50	Oct. 22	1,003
Barrows, Paul M.	Stamford	1	Nov. 23	1,028
Barton, Robert	Hamden	1	Nov. 9	1,016
Beattie, W. H.	New Haven	1	Sept. 10	936
Benbow, A.	Norfolk	1	Sept. 24	972
Bertana, Louis	Glenbrook	2	Sept. 6	924
Bertolf Bros., Inc.	Greenwich	45	Aug. 14	863
Blake and Stuart	Preston	1	Aug. 5	825
Bonnie Brook Gardens	Rowayton	7	Aug. 20	881
Booy, H. W.	Yalesville	4	July 31	803
Botsford, R. C.	East Haven	1	Sept. 9	932
Brainard Nursery & Seed Co.	Thompsonville	15	Aug. 3	821
Braley, S. A.	Burnside	4	July 31	818
Branford Nurseries	Branford	4	Sept. 7	926
Brass, Fred W.	Andover	3	Aug. 5	823
Bretschneider, A.	Danielson	1	Aug. 19	877
Bridgeport Hydraulic Co.	Bridgeport	300	Nov. 12	1,017
Brimfield Gardens Nursery	Wethersfield	3	Aug. 28	906
Bristol Nurseries, Inc.	Bristol	50	Aug. 29	909
Brooklawn Conservatories, Inc.	Bridgeport	1	Nov. 26	1,031
Brooklawn Nursery	Bridgeport	2	Sept. 24	976
Brouwer & Hancock Nurseries	New London	20	Aug. 14	853
Brown, E. M.	Hartford and West Simsbury	2	Sept. 9	930
Bubenicek, Joseph	Woodmont	1	Sept. 19	966
Bulpitt, Henry F.	Darien	4	Aug. 7	839
Bunting's Nurseries, Inc.	Groton	10	Aug. 5	827
Burke, P. J.	Rockville	1	Aug. 14	851
Burr, Morris L.	Westport	1	Sept. 20	968

Name of firm	Address	Acreage	Certificate issued	No. of certificate
Burr & Co., Inc., C. R.	Manchester, Ellington and Durham	400	Aug. 7	836
Burwell, E. E.	New Haven	1	Nov. 23	1,020
Byram Evergreen Nursery	East Portchester	1	Aug. 14	856
Calvanese, John	Southington	1	July 31	816
Candee, Hollis S.	Hartford	6	Sept. 25	977
Cant, Alexander	Springdale	1	Aug. 27	902
Cardarelli, Emilio J.	Cromwell	4	Sept. 6	923
Carey, Alice L.	Cheshire	1	July 31	807
Cascio, Peter J.	Hartford	1	Dec. 16	1,045
Case, Louis L.	Simsbury	1	Sept. 12	943
Chapman, C. B.	Groton	1	Sept. 10	934
Chippendale Nurseries, Inc.	Lyme	2	Aug. 16	873
Clark, Raymond H.	Milford	2	Dec. 31	1,057
Cleary, Arthur B. (2)	Bethel	1	Sept. 17	960
Clyne, George A.	Middlebury	4	Dec. 23	1,046
Conine Nursery Co.	Stratford	65	Aug. 12	846
Conn. Agr. College (Prof. S. P. Hollister)	Storrs	1	Aug. 15	868
Conn. Agr. Expt. Station (W. O. Filley, Forester)	New Haven, Hamden, Norwich, Simsbury, Storrs	5	Oct. 1	988
Conn. Forestry Nursery	Centerbrook	5	Aug. 16	869
Conn. Valley Nurseries	Manchester	5	Aug. 7	837
Cooper's	Nichols	1	Oct. 2	990
Corrigan, James J.	West Haven	1	Sept. 12	944
Couture, E. R. (2)	Westport	2	Oct. 16	1,002
Cragholme Nurseries, Inc.	Greenwich	10	Aug. 20	882
Cromie, G. A.	New Haven	5	Aug. 26	896
Culver, W. B. (2)	Suffield	1	July 31	810
Dallas, Inc., Alexander	Waterbury	2	Aug. 16	875
Darien Nursery	Darien	6	Aug. 12	849
Dawson, Wm. A.	Willimantic	2	Aug. 14	852
Daybreak Nurseries, Inc.	Westport	12	Nov. 29	1,035
DeMars, F. H.	Winsted	1	Oct. 26	1,009
Doebeli, Charles A. (2)	Bridgeport	1	Dec. 31	1,056
Dondi, Augusto	Hamden	1	Oct. 26	1,008
Dougherty's Nursery	Yalesville	1	July 31	805
Dowd, Inc., F. C. (2)	Madison	2	Dec. 31	1,050
Dunlap, D. S.	Cromwell	3	Aug. 15	865
Dunn, James F.	Stamford	3	Aug. 31	918
Eager, Edward M.	Bridgeport	1	Sept. 14	956
East Rock Nursery Co.	New Haven	1	Aug. 17	876
Eell's Sons	Manchester	1	Dec. 10	1,043
Elfgren & Sons, I. P.	East Killingly	2	Aug. 23	888
Elm City Nursery Co., Woodmont Nurseries, Inc.	New Haven and Woodmont	150	Sept. 17	958
Elmgren, C. J.	Cromwell	1	Aug. 30	916

Name of firm	Address	Acreage	Certificate issued	No. of certificate
Elm Grove Cemetery Assn.	Mystic	1	Nov. 23	1,022
Evergreen Nursery Co.	Wilton	16	Aug. 6	833
Eyberse, John (2)	Norwich	1	Aug. 29	911
Fairty, C. H.	New Canaan	1	Oct. 26	1,006
Farmington Valley Nursery	Avon	3	Aug. 26	892
Flower City Rose Co.	Manchester	20	Aug. 7	838
Fraser's Nurseries & Dahlia Gardens	Willimantic	3	Aug. 24	891
Galligan, C. W. (2)	Orange and North Haven	2	Sept. 9	929
Gallup, Amos M. (2)	Stonington	1	Aug. 5	829
Gardner's Nurseries	Rocky Hill	100	Sept. 7	925
Geduldig's Greenhouses	Norwich	3	Sept. 9	931
Gilbert, Henry G.	Danielson	2	Nov. 25	1,024
Giuliano, John S.	Wethersfield	1	Sept. 18	962
Glastonbury Gardens	Glastonbury	1	June 12	795
Glen Terrace Nurseries	Hamden	35	Nov. 12	1,018
Godfrey's Stratfield Nurseries	Bridgeport	25	Dec. 31	1,052
Golden Hill Nursery	Shelton	2	Oct. 22	1,004
Goodwin Nurseries	Bloomfield	7	Aug. 16	874
Grillo, Nicholas	Milldale	1	July 31	815
Haas, E	Devon	1	Dec. 2	1,039
Hall, Henry A. L. (2)	West Haven	1	Sept. 10	937
Hamden Nurseries	Hamden	1	Sept. 7	927
Hansen, Peter	Fairfield	5	Oct. 8	993
Hartford Board of Water Commissioners (2)	Hartford	25	Oct. 1	987
Hawes, Frank M.	West Hartford	1	Aug. 22	884
Hearn, Thomas H.	Washington	1	Nov. 27	1,034
Heath and Co.	Manchester	10	July 26	797
Henninger, Christ	New Britain	1	Sept. 19	965
Hilliard, H. J.	Sound View	1	July 31	809
Hinckley Hill Nursery	Stonington	2	Aug. 14	859
Hiti Nurseries	Pomfret Center	10	Aug. 14	858
Holcomb, H. Parks	Winsted	2	Oct. 11	999
Holcomb, Irving	Simsbury	1	July 29	799
Holbridge, S. E.	Ledyard	4	Aug. 5	824
Hopeville Gardens	Waterbury	3	Nov. 23	1,025
Horan, James F.	Hartford	3	Dec. 31	1,049
Horan and Son, James	Bridgeport	1	Nov. 30	1,038
Houston, Byron D.	Mansfield	15	Nov. 2	1,013
Hoyt, Charles E.	Danbury	2	Sept. 11	941
Hoyt's Sons Co., Inc., Stephen	New Canaan	300	Aug. 30	914
Hunt and Co., W. W.	Hartford	8	Aug. 28	907
Innes, William	Milford	2	Aug. 27	904
Intravaia & Sons, J.	Middletown	1	Aug. 16	872
Jennings, G. S.	Southport	1	Dec. 31	1,060
Johnson, Tom	Bridgeport	1	Sept. 14	954
Judd, T. H.	Danbury	1	Dec. 31	1,053

Name of firm	Address	Acreage	Certificate issued	No. of certificate
Kelley & Son, James J. ..	Darien	7	Aug. 28	908
Keystone Nurseries	Danbury	1	Oct. 1	989
Kuen, Rudolph J. (2) ...	Foxon, East Haven ..	1	Sept. 9	933
Langstroth Conifer Nursery	Danbury	4	Sept. 11	940
Leghorn, John J.	Cromwell	17	Aug. 15	864
Lewis & Valentine, Inc...	Darien	9	Aug. 27	905
Liljenstein, Carl	New London	1	Aug. 5	826
Lundberg, E. A.	Darien	1	Aug. 26	893
Lynch, Mrs. J. H. (2) ...	Ridgefield	5	Aug. 14	855
Mallett, Geo. A.	Bridgeport	15	Sept. 13	948
Maplewood Nursery Co. .	Norwich	3	Dec. 3	1,040
Marigold Farm	New Canaan	15	Oct. 9	994
Mason, Warren S.	Farmington	1	Aug. 14	861
Mather, S. T.	Darien	1	Nov. 27	1,033
McCarthy, John P. (2) ..	Danbury	1	Sept. 11	939
McConville, John	Manchester	1	Aug. 14	857
Meachen, Geo. C.[1]	Stratford	1	Sept. 19	967
Meier, A. R.	West Hartford	1	Nov. 23	1,021
Merwin Lane Nursery ..	East Norwalk	4	Sept. 13	947
Meyer, Carl H. H. (2) ..	Riverside	10	Aug. 14	860
Meyer, Ludwig	Bridgeport	5	Oct. 7	991
Middeleer, Inc.	Darien	20	Aug. 29	910
Millane Nurseries	Cromwell and Deep River	30	Aug. 31	919
Mill River Nursery	Fairfield	6	Sept. 18	964
Minge, G. H.	Rocky Hill	1	Sept. 24	973
Moraio Bros	Stamford	10	Aug. 27	900
Morgan, Wm. F. (2) ...	North Stonington ..	3	Aug. 30	915
Mount Carmel Nursery ..	Mount Carmel	1	Aug. 27	903
Newell, Raymond E.	West Hartford	1	Aug. 9	841
New Britain Board of Water Commissioners..	New Britain	50	Oct. 1	986
New Haven Park Commission	New Haven	16	Aug. 12	847
New London Cemetery Association	New London	1	Sept. 5	920
New London County Nurseries	New London	9	Oct. 16	1,001
New York, New Haven & Hartford Railroad Co. (C. A. Haggerty)..	Stamford	5	Sept. 17	959
Nicolson & Thurston	Litchfield	1	Sept. 13	949
North-Eastern Forestry Co.	Cheshire	60	July 26	796
Norwood Nursery	Hamden	1	Aug. 30	912
Oakland Nurseries	Manchester	5	July 26	798
Oakwood Novelty Gardens	East Hartford	1	Aug. 9	840
Old Orchard Nursery ...	Norwalk	2	Nov. 29	1,036
Ostergren, Herbert	Cromwell	2	July 31	806
Outpost Nurseries	Ridgefield 100		Aug. 14	862
Ouwerkerk, D. K.	Yalesville	10	July 31	804

[1] Deceased.

Name of firm	Address	Acreage	Certificate issued	No. of certificate
Palinkas Nursery (2)	South Norwalk	1	July 31	813
Park Gardens	Bridgeport	1	Dec. 31	1,051
Patterson, John	Old Saybrook	3	Aug. 23	887
Pedersen, Anthon	Stamford	2	Nov. 6	1,014
Pedone & Co., Ludovico	Goshen	3	Sept. 14	952
Pequod Nursery Co.	Yalesville	15	Sept. 14	951
Peschko, Robert	Danbury	1	Sept. 11	942
Pestretto, Frank	West Hartford	1	Dec. 31	1,055
Pestretto, Salvatore	Hartford	1	Sept. 28	983
Pflomm, Charles W. (2)	Bridgeport	1	Sept. 24	975
Phelps & V. T. Hammer Co., J. W.	Branford	3	Dec. 26	1,047
Phillips, Alice G.	Milton	1	Sept. 13	950
Pierson, Inc., A. N.	Cromwell	150	July 31	800
Pinatello, M.	East Hartford	2	Aug. 27	898
Pinchbeck Bros., Inc.	Ridgefield	5	Aug. 22	883
Polish Orphanage Farm	New Britain	1	Oct. 8	992
Pomeroy Blue Spruce Gardens	New Milford	5	Aug. 12	843
Pratt, Jr., George D.	Bridgewater	1	Oct. 26	1,007
Prospect Nurseries, Inc.	Cromwell	12	Aug. 15	866
Prudence Seymour Gardens	New Milford	1	Aug. 12	844
Rabinak, Louis	Deep River	2	Aug. 16	870
Rengerman, A. B.	Granby	1	Aug. 23	890
Reynolds, Stephen	South Norwalk	1	July 31	812
Richards, Warren	Clinton	10	Oct. 10	996
Richmond, Gordon L.	New Milford	3	Aug. 12	842
Rockfall Nursery Co.	Rockfall	90	Aug. 27	901
Rose Hill Nursery (2)	Gildersleeve	1	Nov. 7	1,015
Rottenberg, Julius	Newington	1	Aug. 20	880
Russell, Charles B.	Newington	1	Aug. 6	834
Sage, Hollister	Woodbury	1	July 31	817
Sasco Hill Evergreen Nursery	Southport	1	Sept. 14	955
Saxe-Floto	Waterbury	2	Aug. 14	850
Scarano, Alphonso	Groton	1	Oct. 29	1,011
Schaeffer Bros.	Norwich	4	Nov. 23	1,027
Schneider, Godfrey	West Haven	1	Sept. 12	945
Schulze, Charles T.	Bethel	2	Dec. 3	1,041
Scott's Nurseries	Bloomfield	5	Dec. 12	1,044
Seltsam's Pequonnock Gardens	Bridgeport	1	Sept. 28	980
Seymour, Fred R.	Riverton	1	Sept. 28	979
Shailer, Edwin E.	Haddam	1	Aug. 16	871
Sierman, C. H.	Hartford	8	Sept. 26	978
Silvermine Nurseries	Norwalk	1	July 31	811
Simonsen, H. C.	Plainville	2	Nov. 26	1,032
Snelgrove, S. J.	Windsor	1	Aug. 6	835
Soltes, Martin J.	Shelton	1	Sept. 18	963
Southport Nurseries	Southport	32	Aug. 12	845
South Wilton Nurseries	Wilton	5	Aug. 30	917
Spencer, W. L. L.	Columbia	1	Aug. 5	822
Spring Nurseries	Forestville	1	July 31	814
Stack, Garrett M. (2)	Guilford	1	Sept. 21	969

Name of firm	Address	Acreage	Certificate issued	No. of certificate
Stack, Thomas M. (2) ..	New Milford	1	Sept. 28	982
Stafford Conservatories..	Stafford Springs ...	1	Sept. 17	957
Stannard, E. H.	Wilton, Woodbury and Southbury ...	1	Sept. 28	981
State Highway Department (Landscape Division)	Ellington, Putnam, Wethersfield and Wilton	6	Oct. 11	998
State of Conn. (A. F. Hawes, State Forester)	Simsbury, Hartford	5	Aug. 23	889
State Street Nursery ...	New Haven	2	Aug. 14	854
Steck, Jr., C. A.	Bethel	2	Nov. 23	1,019
Steck, Charles A.	Newtown	10	Dec. 31	1,058
Steck, Nurseries, Inc. ...	Farmington	10	Dec. 31	1,059
Steck, Sarah B.	Bethel	1	Sept. 30	985
Stolle, J. W.	Bethel	1	Sept. 11	938
Stratford Rose Nurseries	Stratford	2	Sept. 14	953
Sunridge Nurseries (2)..	Greenwich	10	Aug. 22	885
Sylvan Avenue Greenhouse	Bridgeport	2	Nov. 23	1,029
Tanner, Edward G.	Manchester	1	Aug. 27	899
Thomas & Sons, Inc., W. D.	Hamden	2	Dec. 31	1,048
Torizzo, P. A.	West Hartford	1	Nov. 23	1,023
Tree Farms, Inc.	Cromwell	15	Sept. 2	946
Tryon, George W.	North Stonington ..	1	Aug. 5	832
Upson, R. E.	Marion	2	Sept. 5	921
Van der Bom, F.	Bethel	5	Sept. 17	961
Vanderbrook & Son, C. L.	Manchester	30	Aug. 12	848
Vanderstam, C. L.	Yalesville	2	July 31	801
Van Wilgen Nurseries ..	Branford	10	Oct. 15	1,000
Vasileff, Nicholas	Greenwich	4	Nov. 23	1,026
Verkade's Nurseries	New London	50	Oct. 29	1,010
Vernik Nursery, John ...	Bridgeport	2	Sept. 24	974
Wallace Nursery	Wallingford	8	July 31	808
Wegner, C. F.	Noroton Heights ...	1	Oct. 9	995
Weirether, Leo	West Haven	1	Aug. 22	886
Westville Nurseries	New Haven	1	Dec. 31	1,054
Wheeler, C. B.	Stonington	1	Aug. 5	830
Wilcox, Elmer E.	Guilford	1	Sept. 21	970
Wild, Henry	Greenwich	2	Aug. 19	878
Wild, Henry	Norwalk	30	Aug. 19	879
Williams, Harry G.	Shelton	1	Sept. 28	984
Wilridge Nurseries (2)..	Branchville	2	Aug. 30	913
Wilson & Co., C. E.	Manchester 100		Sept. 6	922
Wilson, Robert L.	Stamford	1	Aug. 26	895
Woodbridge Nursery Co.	New Haven	6	Oct. 10	998
Woodruff, C. V.	Orange	1	Sept. 7	928
Wyllie, David	Whitneyville	1	Dec. 7	1,042
Yale Forest School Nursery	New Haven	2	Sept. 10	935

Name of firm	Address	Acreage	Certificate issued	No. of certificate
Yale University Landscape Dept.	New Haven	11	Aug. 26	897
Zack Co., H. J.	Deep River	15	Nov. 30	1,037
Total acres		3,157		

Inspection of Raspberry Plantations

Only one firm applied in 1929 for the special inspection and certification of raspberry plants on account of the mosaic and allied diseases in order to meet the requirements of Michigan, Minnesota, New York, Vermont and Wisconsin. The inspections were made and a certificate issued to cover only the varieties indicated, as follows:

SPECIAL CERTIFICATE ON RASPBERRY PLANTS

Name of firm	Address	Varieties	Certificate Date of issue	Certificate Number
Conine Nursery Co.	Stratford	Latham LaFrance Saint Regis	Oct. 15	19

Registration of Nursery Dealers

Chapter 265, Public Acts of 1925, provides that dealers in nursery stock must register each year, on or before March 1, with the State Entomologist, and cite the principal sources of their nursery stock. All dealers' permits are for the remainder of the calendar year and expire on December 31. During the year 104 such dealers have registered and received permits. The list of dealers is on file in the office of the State Entomologist, but is not printed in this Report.

Registration of Out-of-State Nurserymen

Nurserymen in other states wishing to ship stock into Connecticut are required to file with the State Entomologist signed copies of their nursery inspection certificates and make application for permits to ship stock into the state. These permits are valid only for the periods covered by the certificates placed on file. During the year 258 permits were issued to nurserymen in other states, but the list of firms receiving them is not printed in this Report.

Parcel Certificates

In addition to the regular inspection and certification of nursery stock, occasionally individuals wish to send shrubs and plants to their friends, and sometimes nurserymen need to ship packages

before receiving their regular certificates. Consequently 352 separate parcels of nursery stock were inspected and package certificates furnished.

Inspection of Narcissus Bulbs

On account of Federal Quarantine No. 62, narcissus bulbs grown in Connecticut cannot be shipped into other states unless given two inspections, one in the field in May, and the other after the bulbs have been dug for shipment. In case they are found to be infested with bulb flies or eelworms, they must then be treated. During the year 22,000 such bulbs were inspected and certified.

Inspection of Laurel and Decorative Materials

Considerable decorative material is gathered each year in Connecticut woodlands and shipped into New York City. This is mostly mountain laurel, *Kalmia latifolia.* If gathered within the gipsy moth quarantined area, it is examined by Federal inspectors, and if found clean, is certified for shipment. Much of it is collected outside the quarantined area and yet cannot enter New York without being certified. During the year 42 such certificates were issued.

Inspection of Shelled Seed Corn

On account of the European corn borer having been found in a portion of Connecticut, certain states would not allow shelled sweet corn for seed to enter unless it had been inspected and certified to be free from bits of cob large enough to carry borers. Therefore a large quantity of such seed corn was inspected as it came through the cleaning mill, and 1084 certificate tags were issued covering shelled corn and certain other seeds.

Blister Rust Control Area Permits

In 1929, nine blister rust control areas were legally established in Connecticut. Under such conditions, the Federal regulations require that before any shipments of currants, gooseberries or other species of *Ribes* or white pine or other five-leaf pines are shipped into the state, the shipper must apply to the State Entomologist for a permit. The shipper must give name and address of both consignor and consignee, name and number of plants of each species and variety to be shipped. If the shipment is to be sent to a point outside the control areas and does not contain any prohibited plants, the permit is granted. During the year 334 such permits have been issued. Black currants are now debarred by statute. The text of the law follows:

PUBLIC ACTS OF 1929

CHAPTER 172

AN ACT PROHIBITING THE GROWING OF BLACK CURRANT PLANTS

Be it enacted by the Senate and House of Representatives in General Assembly convened:

SECTION 1. Any person who shall grow, plant, propagate, cultivate, sell, transport or possess any plant, root or cutting of the European black currant, or *Ribes nigrum*, shall be fined not less than five dollars nor more than twenty-five dollars.

SEC. 2. The director of the Connecticut Agricultural Experiment Station is authorized to seize and destroy any plants, roots or cuttings of said European black currant found in the State.

Approved June 3, 1929.

INSPECTION OF IMPORTED NURSERY STOCK

W. E. Britton and M. P. Zappe

Since 1920, the only nursery stock permitted to enter Connecticut directly from foreign countries has been fruit tree seedlings and rose stocks for propagation. This material enters the United States under a Federal system of notices and permits and is released at ports of entry, to be inspected by state inspectors at destination points. All other plant material brought into the country must go to Washington, where it is examined, and where it may be detained, fumigated or destroyed, if there is any question of infestation. All proper precautions are taken by the Plant Quarantine and Control Administration before allowing the plants to be distributed.

The imported nursery stock entering Connecticut in 1928-1929 was inspected at destination by Mr. Zappe, assisted at rush periods by Mr. Johnson, Mr. McFarland and Dr. Friend. They inspected fewer shipments and a smaller number of plants than last year, as the following table shows:

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
1925	27	277	2,977,346
1926	32	347	3,443,357
1927	31	321	3,229,915
1928	26	277	2,680,700
1929	23	225	2,022,475

Sources of Imported Nursery Stock, 1928-1929

The greatest number of shipments and plants came from Holland, as in some of the preceding years. The following table shows the sources of this stock:

Country	No. of shipments	No. of cases	No. of plants
Holland	14	137	1,015,475
France	7	85	989,000
England	2	3	18,000
Total	23	225	2,022,475

These 23 shipments were imported by 10 different Connecticut firms, two of which imported 191 of the 225 cases containing 1,800,075 plants. Of the whole number of shipments, 14 contained only rose stocks, six were only fruit stocks and three contained both rose and fruit stocks.

Of this plant material inspected, 1,128,575 plants, or about 55 per cent, were rose stocks and the remainder, 893,000 plants, or about 45 per cent, were fruit seedlings, the quantity of each different variety being shown in the following table:

KINDS OF STOCK IMPORTED

ROSE STOCKS		
Rosa manetti	998,575	
Rosa rugosa	130,000	
		1,128,575
FRUIT STOCKS		
Apple (all kinds)	290,800	
Cherry (all kinds)	391,600	
Pear	151,500	
Plum	50,000	
Quince	10,000	
		893,900
Total		2,022,475

Time of Arrival and Inspection

This imported nursery stock begins to arrive in the late fall and continues into the winter. Some importers desire an immediate inspection, but others place the stock in storage and ask to have it inspected a little each week as they can use it in grafting and propagating. The following table shows the quantities of stock as inspected by months:

Month	No. of shipments	No. of cases	No. of plants
November	1	2	15,000
December	4	27	231,500
January	9	114	1,212,000
February	5	77	524,575
March	3	4	29,500
April	1	1	9,900
Total	23	225	2,022,475

The time required to inspect this stock is equivalent to one man working 21 days, and this time, together with traveling and other necessary expenses, amounts to nearly $400.

In addition to the material enumerated and tabulated above, there were 13 shipments of new varieties of plants and 28 shipments containing 685 pounds of tree seeds which were not inspected in Connecticut. The plants were inspected and the seeds fumigated with carbon disulfide at Washington, D. C. Reports of the 23 shipments inspected were sent to the Plant Quarantine and Control Administration, Washington, D. C.

Results of Inspection

Of the 23 shipments inspected, 12 shipments, or 52 per cent, were found free from infestation, but in the other 11 shipments, or 48 per cent, there were insects, small animals or plant diseases, some of which are well known pests. Details of these infestations are given below:

INFESTATIONS INTERCEPTED ON IMPORTED NURSERY STOCK

11 SHIPMENTS INFESTED

INSECTS AND OTHER ANIMALS

Aporia crataegi Linn. Nests on apple (1 shipment), Andre Choplin, Maze, France.

Calophasia lunula Hubn. On pear (2 shipments), Andre Choplin, Maze, and A. Fermaud, Angers, France.

Emphytus cinctus Linn. On rose (8 shipments), Andre Choplin, Maze, A. Fermaud and Franco-American Seedling Co., Angers, France; W. C. Slocock, Woking, England; Felix & Dykhius, and Association Flora, Boskoop, Holland.

Lepidopterous pupa. On rose and pear (2 shipments), Andre Choplin, Maze, France; C. Klyn & Co., Boskoop, Holland.

Notolophus antiqua Linn. Rusty tussock moth eggs on cherry, apple and rose (3 shipments), Franco-American Seedling Co., Angers, France; F. J. Grootendorst and Association Flora, Boskoop, Holland.

Spiders Eggs. On rose and pear (2 shipments), Andre Choplin, Maze, and Franco-American Seedling Co., Angers, France.

Woolly aphid. On apple (1 shipment), A. Fermaud, Angers, France.

PLANT DISEASES

Crown Gall on Manetti rose (1 shipment), Association Flora, Boskoop, Holland.

INSPECTION OF APIARIES IN 1929

In 1929, as in former seasons, the apiaries of Connecticut were inspected by Mr. H. W. Coley, of Westport, and Mr. A. W. Yates, of Hartford, who have been paid for each day employed on this work. Mr. Coley covered the southern half of the state, Fairfield, New Haven, Middlesex and New London Counties, and Mr. Yates the northern half, Litchfield, Hartford, Tolland and Windham Counties.

The appropriation, now $4,000 for two years, has never been sufficient to cover the cost of inspecting all known apiaries in the state each year, so an attempt has been made to inspect some of them in alternate seasons in order to cover them all in each two-year period.

This inspection work in 1929 required 167 man days, and together with traveling expenses cost $2,169.10. In all 990 apiaries containing 9,559 colonies were inspected, in 1929, as against 852 apiaries containing 8,133 colonies in 1928. The apiaries averaged 9.55 colonies each in 1929 and 9.41 each in 1928.

The following table shows the number of apiaries and colonies inspected, the average number of colonies per apiary, and the average cost of inspecting each apiary and colony for each year since the inspection started in 1910:

TWENTY-YEAR RECORD OF APIARY INSPECTION IN CONNECTICUT

Year	No. of apiaries	No. of colonies	Average No. colonies per apiary	Average 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
1925	766	8,257	10.7	2.45	.22
1926	814	7,923	9.7	2.35	.24
1927	803	8,133	10.1	2.37	.234
1928	852	8,023	9.41	2.12	.225
1929	990	9,559	9.55	2.19	.227

In 1929, apiaries were inspected in 141 towns as against 149 towns in 1928 and 135 towns in 1927. Inspections were made in 1929 in the following 11 towns not visited in 1928: New Haven County—Ansonia, Beacon Falls, West Haven; Middlesex County—Durham; Litchfield County—Barkhamsted, Warren; Windham County—Ashford, Chaplin, Eastford, Hampton, Thompson.

On the other hand, in the following 20 towns visited in 1928, no inspections were made in 1929: Fairfield County—New Fairfield, Sherman, Westport; New Haven County—Bethany, Milford, New Haven, Orange, Oxford, Southbury, Waterbury, Woodbridge; Middlesex County—Saybrook; New London County—Bozrah, New London, Preston, Sprague; Litchfield County—Bridgewater, New Milford, Roxbury; Tolland County—Tolland.

In the following eight towns no inspections were made in either 1928 or 1929: Fairfield County—Bridgeport, Monroe, Newtown, Shelton, Trumbull, Weston; New London County—Lisbon; Tolland County—Willington.

In 1929, one apiary was inspected in Warren where for several years it was believed that no bees were kept; at least, none had been discovered.

European Foul Brood

European foul brood is a disease of the young larvae in the comb caused by a bacterial germ known as *Bacillus pluton*. The cell contents often have the odor of fermentation, though they are not particularly offensive and are not gelatinous or ropy. This disease is usually more troublesome in early summer than at other seasons and requeening with Italian queens and uniting two or more weak colonies to make them strong are the usual methods of treatment.

Of the 990 apiaries and 9,559 colonies inspected in 1929, only two apiaries and three colonies were found infested with European foul brood. This is the lightest infestation of both apiaries and colonies found since the inspection work started in 1910, and amounts to .02 per cent of the apiaries and .003 per cent of the colonies.

The following table shows a complete record of percentages of European foul brood infestation in Connecticut since the inspections were started in 1910:

RECORD OF EUROPEAN FOUL BROOD

Year	Percentage of infestation Apiaries	Colonies	Year	Percentage of infestation Apiaries	Colonies
1910	75.9	49.7	1920	4.3	1.5
1911	51.8	27.4	1921	3.91	1.26
1912	47.7	23.5	1922	4.14	.85
1913	44.4	24.5	1923	2.34	.36
1914	32.6	13.9	1924	1.78	.526
1915	26.1	10.3	1925	2.48	.507
1916	18.8	7.05	1926	3.19	.858
1917	16.7	4.86	1927	1.12	.282
1918	9.8	3.3	1928	1.05	.324
1919	6.6	1.2	1929	.02	.003

During the season of 1929, European foul brood was found only in two towns: Winchester in Litchfield County, and Coventry in Tolland County. No apiaries infested with this disease were found in Fairfield, New Haven, Middlesex, New London, Hartford, and Windham Counties.

American Foul Brood

American foul brood is likewise a disease of the larvae in the cells, but it occurs at a time when the larvae are nearly mature or more advanced in their development than does the European foul brood. American foul brood is also caused by a bacterial organism or germ known to science as *Bacillus larvae*. The symptoms appear after the cells have been sealed and often after the brood has pupated. The cells are shrunken and if opened the contents have a very offensive odor and a peculiar stringy or ropy consistency. The usual remedy is to shake the bees into clean hives, destroy the infected combs, and disinfect or destroy the old hives. The diseased combs may be sterilized by soaking them in an alcohol-formalin solution containing 20 per cent of formalin, but this treatment is not widely practiced.

Of the 990 apiaries and 9,559 colonies inspected in 1929, 46 apiaries and 115 colonies were infested with American foul brood. This infestation is equivalent to 4.64 per cent of the apiaries and 1.2 per cent of the colonies inspected in 1929. This record is slightly higher than that of 1928; in fact, it is the highest percentage of infestation of American foul brood ever found by the inspectors in any season in Connecticut.

The following table shows a complete record of American foul brood since the apiary inspection work was started in Connecticut in 1910:

RECORD OF AMERICAN FOUL BROOD

Year	Percentage of infestation Apiaries	Colonies	Year	Percentage of infestation Apiaries	Colonies
1910	0	0	1920	1.18	.25
1911	0	0	1921	2.5	.56
1912	0	0	1922	1.38	.27
1913	0	0	1923	.985	.323
1914	1.07	.7	1924	1.04	.22
1915	.8	.18	1925	3.26	.424
1916	1.07	.15	1926	1.72	.29
1917	.42	.17	1927	3.11	.70
1918	1.01	.32	1928	4.213	.98
1919	3	1.1	1929	4.64	1.2

In 1929, American foul brood was found in the following 24 towns: Fairfield County—Danbury, Fairfield, Greenwich, Ridgefield, Stamford, Wilton; New Haven County—Cheshire, Hamden, Middlebury, Naugatuck, North Haven, Prospect, Wallingford; Middlesex County—East Hampton, Essex, Middlefield; New London County—Stonington; Litchfield County—Plymouth, Watertown; Hartford County—Bristol, New Britain, West Hartford, Wethersfield; Tolland County—Ellington. This disease was not found in Windham County.

Sacbrood

Sacbrood or pickled brood is a disease that causes the larvae or brood to die at about the time that the cells are capped. They lie on their backs with heads turned upward. Though the body is swollen and the contents are watery, there is no ropiness. The entire cell contents may be removed intact as if enclosed in a sac. The color, though variable, is often light yellowish brown with head nearly black.

The cause of this disease is thought to be a filterable virus, and the usual treatment is to unite the weak colonies to make strong ones. In rare cases where the entire apiary becomes diseased, all colonies should be supplied with new queens.

The following table shows the record of sacbrood in Connecticut since the inspection work began in 1910:

RECORD OF SACBROOD

Year	Percentage of infestation Apiaries	Colonies	Year	Percentage of infestation Apiaries	Colonies
1910	0	0	1920	1.18	.229
1911	....	.51	1921	1.06	.157
1912	....	Several	1922	1.37	.187
1913	....	2.8	1923	.53	.086
1914	2.59	.721	1924	1.78	.52
1915	2.02	.47	1925	3.39	.836
1916	.428	.051	1926	1.1	.138
1917	1.48	.199	1927	.03	.0036
1918	.253	.032	1928	.035	.087
1919	1.24	.19	1929	.001	.0006

This year sacbrood was found in Connecticut only in Wallingford in New Haven County.

Statistics of Inspection

The statistics of apiary inspection by towns and counties are given on the following pages, with summary on page 527.

INSPECTION OF APIARIES, 1929

Town	Apiaries		Colonies		Foul brood		
	Inspected	Diseased	Inspected	Diseased	American	European	Sacbrood
Fairfield County							
Bethel	2	0	28	0	0	0	0
Bridgeport	0	0	0	0	0	0	0
Brookfield	4	0	84	0	0	0	0
Danbury	7	2	62	8	8	0	0
Darien	2	0	45	0	0	0	0
Easton	2	0	86	0	0	0	0
Fairfield	8	2	86	5	5	0	0
Greenwich	9	3	74	8	8	0	0
Monroe	0	0	0	0	0	0	0
New Canaan	11	0	84	0	0	0	0
New Fairfield	0	0	0	0	0	0	0
Newtown	0	0	0	0	0	0	0
Norwalk	6	0	57	0	0	0	0
Redding	5	0	94	0	0	0	0
Ridgefield	7	3	54	9	9	0	0
Shelton	0	0	0	0	0	0	0
Sherman	0	0	0	0	0	0	0
Stamford	3	1	20	1	1	0	0
Stratford	1	0	2	0	0	0	0
Trumbull	0	0	0	0	0	0	0
Weston	0	0	0	0	0	0	0
Westport	0	0	0	0	0	0	0
Wilton[1]	7	1	121	3	3	0	0
	74	12	897	34	34	0	0

Town	Apiaries		Colonies		Foul brood		
	Inspected	Diseased	Inspected	Diseased	American	European	Sacbrood
New Haven County							
Ansonia	2	0	6	0	0	0	0
Beacon Falls	1	0	24	0	0	0	0
Bethany	0	0	0	0	0	0	0
Branford	2	0	21	0	0	0	0
Cheshire	11	3	78	10	10	0	0
Derby	2	0	9	0	0	0	0
East Haven	2	0	22	0	0	0	0
Guilford	3	0	50	0	0	0	0
Hamden	3	1	31	6	6	0	0
Madison	3	0	18	0	0	0	0
Meriden	11	0	159	0	0	0	0
Middlebury	6	3	91	6	6	0	0
Milford	0	0	0	0	0	0	0
Naugatuck	4	1	76	3	3	0	0
New Haven	0	0	0	0	0	0	0

[1] One colony inspected twice.

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
New Haven County—*Cont.*							
North Branford	1	0	30	0	0	0	0
North Haven.	1	1	2	1	1	0	0
Orange	0	0	0	0	0	0	0
Oxford	0	0	0	0	0	0	0
Prospect	4	1	39	1	1	0	0
Seymour	2	0	4	0	0	0	0
Southbury ...	0	0	0	0	0	0	0
Wallingford ..	18	5	163	14	8	0	6
Waterbury ..	0	0	0	0	0	0	0
West Haven..	4	0	47	0	0	0	0
Wolcott	4	0	12	0	0	0	0
Woodbridge ..	0	0	0	0	0	0	0
	84	15	882	41	35	0	6

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
Middlesex County							
Chester	10	0	60	0	0	0	0
Clinton	4	0	63	0	0	0	0
Cromwell	4	0	67	0	0	0	0
Durham	11	0	227	0	0	0	0
East Haddam	8	0	242	0	0	0	0
East Hampton	11	2	150	6	6	0	0
Essex	4	1	45	1	1	0	0
Haddam	3	0	50	0	0	0	0
Killingworth..	4	0	67	0	0	0	0
Middlefield ..	4	3	44	11	11	0	0
Middletown ..	6	0	98	0	0	0	0
Old Saybrook	5	0	64	0	0	0	0
Portland	9	0	89	0	0	0	0
Saybrook	0	0	0	0	0	0	0
Westbrook ..	1	0	4	0	0	0	0
	84	6	1,270	18	18	0	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
New London County							
Bozrah	0	0	0	0	0	0	0
Colchester ...	12	0	188	0	0	0	0
East Lyme ...	4	0	133	0	0	0	0
Franklin	3	0	95	0	0	0	0
Griswold	4	0	79	0	0	0	0
Groton	6	0	79	0	0	0	0
Lebanon	12	0	208	0	0	0	0
Ledyard	5	0	59	0	0	0	0
Lisbon	0	0	0	0	0	0	0
Lyme	1	0	14	0	0	0	0
Montville	8	0	84	0	0	0	0
New London..	0	0	0	0	0	0	0
No. Stonington	1	0	54	0	0	0	0
Norwich	9	0	230	0	0	0	0
Old Lyme ...	1	0	14	0	0	0	0
Preston	0	0	0	0	0	0	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
New London County—*Cont.*							
Salem	2	0	21	0	0	0	0
Sprague	0	0	0	0	0	0	0
Stonington	7	1	59	2	2	0	0
Voluntown	3	0	25	0	0	0	0
Waterford	3	0	24	0	0	0	0
	81	1	1,366	2	2	0	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
Litchfield County							
Barkhamsted	6	0	23	0	0	0	0
Bethlehem	4	0	24	0	0	0	0
Bridgewater	0	0	0	0	0	0	0
Canaan	2	0	15	0	0	0	0
Colebrook	7	0	48	0	0	0	0
Cornwall	6	0	33	0	0	0	0
Goshen	4	0	43	0	0	0	0
Harwinton	6	0	22	0	0	0	0
Kent	7	0	122	0	0	0	0
Litchfield	14	0	155	0	0	0	0
Morris	3	0	22	0	0	0	0
New Hartford	12	0	51	0	0	0	0
New Milford	0	0	0	0	0	0	0
Norfolk	5	0	24	0	0	0	0
North Canaan	6	0	91	0	0	0	0
Plymouth	6	2	38	2	2	0	0
Roxbury	0	0	0	0	0	0	0
Salisbury	6	0	79	0	0	0	0
Sharon[1]	9	1	175	1	0	0	0
Thomaston	16	0	74	0	0	0	0
Torrington	14	0	87	0	0	0	0
Warren	1	0	6	0	0	0	0
Washington	5	0	139	0	0	0	0
Watertown	16	1	112	1	1	0	0
Winchester	17	1	86	1	0	1	0
Woodbury	3	0	73	0	0	0	0
	175	5	1,542	5	3	1	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
Hartford County							
Avon	13	0	72	0	0	0	0
Berlin	15	0	210	0	0	0	0
Bloomfield	9	0	247	0	0	0	0
Bristol	17	5	155	14	14	0	0
Burlington	9	0	47	0	0	0	0
Canton	9	0	74	0	0	0	0
East Granby	2	0	15	0	0	0	0
East Hartford	9	0	39	0	0	0	0
East Windsor	14	0	92	0	0	0	0
Enfield	7	0	46	0	0	0	0
Farmington	16	0	108	0	0	0	0

[1] One bee paralysis.

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Foul brood Sacbrood
Hartford County—*Cont.*							
Glastonbury ..	15	0	131	0	0	0	0
Granby	11	0	108	0	0	0	0
Hartford	5	0	36	0	0	0	0
Hartland	3	0	110	0	0	0	0
Manchester ..	14	0	83	0	0	0	0
Marlborough..	2	0	31	0	0	0	0
New Britain[1]..	20	1	100	1	0	0	0
Newington ...	5	0	28	0	0	0	0
Plainville	13	0	41	0	0	0	0
Rocky Hill ..	4	0	46	0	0	0	0
Simsbury	10	0	52	0	0	0	0
Southington ..	13	0	73	0	0	0	0
South Windsor	7	0	52	0	0	0	0
Suffield	7	0	69	0	0	0	0
West Hartford	14	1	115	2	2	0	0
Wethersfield[1]..	14	1	65	1	0	0	0
Windsor	16	0	125	0	0	0	0
Windsor Locks	4	0	14	0	0	0	0
	297	8	2,346	18	16	0	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Foul brood Sacbrood
Tolland County							
Andover	4	0	9	0	0	0	0
Bolton	2	0	19	0	0	0	0
Columbia	6	0	34	0	0	0	0
Coventry	13	1	100	2	0	2	0
Ellington	17	3	85	7	7	0	0
Hebron	6	0	30	0	0	0	0
Mansfield	7	0	24	0	0	0	0
Somers	7	0	47	0	0	0	0
Stafford	9	0	45	0	0	0	0
Tolland	0	0	0	0	0	0	0
Union	1	0	7	0	0	0	0
Vernon	10	0	51	0	0	0	0
Willington ...	0	0	0	0	0	0	0
	82	4	451	9	7	2	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Foul brood Sacbrood
Windham County							
Ashford	4	0	39	0	0	0	0
Brooklyn	6	0	214	0	0	0	0
Canterbury ..	3	0	25	0	0	0	0
Chaplin	3	0	15	0	0	0	0
Eastford	6	0	13	0	0	0	0
Hampton	6	0	30	0	0	0	0
Killingly	15	0	65	0	0	0	0
Plainfield	6	0	28	0	0	0	0
Pomfret	9	0	61	0	0	0	0
Putnam	4	0	26	0	0	0	0
Scotland	9	0	41	0	0	0	0
Sterling	4	0	8	0	0	0	0

[1] One bee paralysis.

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
Windham County—*Cont.*							
Thompson ...	6	0	39	0	0	0	0
Windham	17	0	94	0	0	0	0
Woodstock ..	15	0	117	0	0	0	0
	113	0	805	0	0	0	0

SUMMARY

County	No. towns	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
Fairfield ...	14	74	12	897	34	34	0	0
New Haven	19	84	15	882	41	35	0	6
Middlesex..	14	84	6	1,270	18	18	0	0
New London	16	81	1	1,366	2	2	0	0
Litchfield[1]..	23	175	5	1,542	5	3	1	0
Hartford[2] ..	30	297	3	2,346	18	16	0	0
Tolland ...	11	82	4	451	9	7	2	0
Windham ..	15	113	0	805	0	0	0	0
	142	990	51	9,559	127	115	3	6

	No. apiaries	No. colonies
Inspected	990	9,559
Infested with European foul brood	2	3
Per cent infested	.02	.003
Infested with American foul brood	46	115
Per cent infested	4.64	1.2
Infested with sacbrood	1	6
Infested with bee paralysis	3	3
Average number of colonies per apiary		9.55
Cost of inspection		$2,169.10
Average cost per apiary		$2.19
Average cost per colony		.227

Registration of Bees: New Legislation

Though the law requiring beekeepers to register with the town clerk of the town in which the bees are kept, was first enacted in 1919, there has never been anything like a complete registration of all apiaries. There have been few prosecutions for failing to register. In other words, the law has not been enforced.

The General Assembly of 1923 passed an amendment to this law requiring the town clerks to report to the State Entomologist in case bees had been registered as of October 1, and to send a list of such registrations on or before the next February 1. This law did not require them to report in case no bees were registered, and as many failed to report, it was difficult to ascertain whether they were complying with the law or violating it. Though notices were sent repeatedly in certain cases, the needed information could be obtained only by making a personal visit to the office of the town clerk, which is, of course, expensive.

[1] One bee paralysis.
[2] Two bee paralysis.

The General Assembly of 1929 further amended this law requiring town clerks to report to the State Entomologist on or before December 1, and the report does not depend upon registrations. They are supposed to report whether registrations have been made or not. The text of this amendment is as follows:

PUBLIC ACTS OF 1929

CHAPTER 50

AN ACT AMENDING AN ACT CONCERNING THE REGISTRATION OF THE OWNERS OF BEES

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section two of chapter 174 of the public acts of 1919 as amended by chapter 129 of the public acts of 1923 is amended to read as follows: 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, on or before December first, report to the state entomologist whether or not any such owners have been registered by him, and file with said state entomologist a complete list of such registrations.

Approved April 10, 1929.

During 1929, 712 apiaries and 6,752 colonies were registered with the town clerks. This is slightly more than two-thirds the number of apiaries and colonies that were inspected during the season, and in 27 towns no inspections were made.

The number of apiaries and colonies in Connecticut has been a matter of speculation. In 1929, 990 apiaries and 9,559 colonies were inspected and 712 apiaries and 6,752 colonies were registered with the town clerks. After checking the lists carefully and deducting those counted twice, definite figures are obtained and shown in the following table:

1929	Apiaries	Colonies
Inspected	990	9,559
Registered but not inspected	396	2,787
Total	1,386	12,346

There were eight towns in which no bees were registered and 27 towns in which no bees were inspected. As there are probably a moderate number of apiaries which were neither registered nor inspected in 1929, it seems fair to assume that there are at least 15,000 colonies of bees in Connecticut.

The text of the registration law as it now stands on the statute books 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 with the name and place of residence of the registrant and the definite location in the town where bees are kept by him shall be recorded in a separate book in the office of the town clerk, which record shall be accessible to the public. Each town clerk shall, on or before December first, report to the state entomologist whether or not any such owners have been registered by him, and file with said state entomologist a complete list of such registrations.

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."

GIPSY MOTH WORK IN CONNECTICUT IN 1929

John T. Ashworth and W. E. Britton

The work of suppressing the gipsy moth is conducted by the State Entomologist in coöperation with the Federal Plant Quaran-

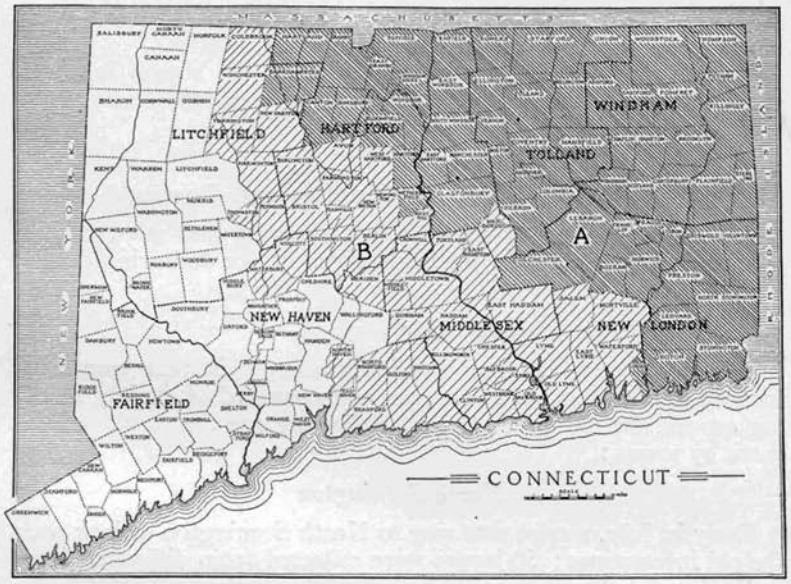

FIGURE 45. Map of Connecticut showing areas at present quarantined on account of the gipsy moth. A, generally infested; B, lightly infested.

tine and Control Administration. During the year, this work has been continued in the same manner as in former years and there have been no important or unusual developments. No extensive wind-spread has been discovered and no noticeable defoliation

such as has taken place in certain portions of Massachusetts, Maine and New Hampshire has occurred in Connecticut. There has been no change in the quarantine and the areas are the same as last year as shown in Figure 45. For the most part, the Federal forces have operated along the western border of the infested area in order to prevent further spread, and the state forces have covered the area further eastward where infestations are known to occur.

The appropriation is inadequate to provide for scouting in all infested towns each season; consequently, they are covered under the plan of a two-year rotation. No parasites were distributed in 1929.

We are greatly indebted to Mr. A. F. Burgess and Mr. H. L. Blaisdell in charge of the Federal Control work for their splendid coöperation, and we here express to them our appreciation and thanks.

Some scouting was done for the satin moth, which will be mentioned on another page of this report.

New Equipment

The only new equipment obtained during the season has been small tools and three new Ford light trucks to replace the three oldest ones.

Details of Work by Counties and Towns

A detailed account of the scouting, spraying and other control operations in the infested towns, is given on the following pages:

New London County

The work done in New London County this year was commenced near the end of the season and consisted of rapidly scouting around the old infestations. Following are the results of the work by towns:

North Stonington

Early in July, a crew was sent to North Stonington to look over the old infestations; 50 larvae were collected from different places in the town, but no heavy feeding was observed or reported.

Stonington

The same procedure was taken in regard to the town of Stonington, where 53 larvae were found. As in the case of North Stonington, no heavy feeding occurred, although larvae were picked up in several places in the village of Stonington.

Groton

25 Infestations 190 Egg-clusters

Twenty-two miles of roadside scouting was completed in Groton and 25 small colonies were discovered. The largest was one of 17 egg-clusters found on property owned by the Rev. G. Smith of Butler Court; a colony of 16 egg-clusters was found on apple and shade trees owned by Mr. M. Collins, on the New London-Mystic road; another small colony of 16 egg-clusters was discovered on three maple and one apple tree in West Mystic, on property owned by the Sea Sled Corporation. The other colonies ranged from one to 15 egg-clusters each. Seventeen of these colonies were sprayed by state men during the early part of June. In a check-up of these colonies after the spraying season, 132 larvae and pupae were found and killed.

New London

14 Infestations 490 Egg-clusters

Two large colonies of gipsy moth egg-clusters were found by state men while scouting New London this season; in fact, these two colonies contained 411 of a total of 490 egg-clusters found within the limits of the town. The largest was one of 327 egg-clusters in oak grove on estates owned by Messrs. Sackett and Rayburn, located on Glenwood Avenue. The other was one of 84 egg-clusters, at 67 Federal Street, on elm and maple trees owned by Mr. F. M. Butler. The other twelve colonies were all small, 17 egg-clusters being the largest. This colony was on pine and pear trees owned by Mr. J. Chamberlain at 69 Howard Street. Ten of these 14 colonies were sprayed by state men on June 6. Later in the summer men were sent to New London to check the results of spraying and a total of 283 larvae and pupae were found and destroyed.

East Lyme and Old Lyme

Work in these towns this year consisted of scouting around places that have been infested. A considerable territory outside of all the infestations was examined and no trace of the gipsy moth found in these towns.

Tolland County

Bolton

1 Infestation 1 Egg-cluster

Before Tolland County could be scouted this year, egg-clusters were hatching and larvae feeding; however, while waiting for the foliage to get out so that spraying would be effective, a crew was sent to last year's woodland infestation in Bolton on land owned by Mr. Samuel Alvord. Between seven and eight acres of wood-

land and three and a half miles of roadside were scouted around this colony. A total of 87 egg-clusters were discovered on 29 trees scattered throughout the woodland. This colony was sprayed on June 12 by state men, 6,400 gallons of liquid spray being used.

Stafford and Willington

The spraying of colonies discovered during the winter scouting was completed by June 20. It was thought advisable to scout for larvae in the towns of Stafford and Willington and to spray wherever the pest was found. This could be done to good advantage as the larvae had not at this time passed the heavy feeding stage; therefore, a crew was started in Willington on June 22. Three colonies were found and sprayed; then this crew moved to Stafford where they worked until June 29, using the same procedure as in Willington. Eleven colonies were discovered and sprayed. This was all the work that time, money, and men would permit in Tolland County this season. More work is planned to be done in this county next year.

Hartford County

Avon

1 Infestation 382 Egg-clusters

One large new infestation of 382 egg-clusters was found by the state men scouting Avon this season, in a pasture owned by Mr. W. R. Hodge on the west slope of Talcott Mountain. This colony is considered a very dangerous one, on account of the high elevation, as an easterly wind in the spring would spread the young larvae far westward. Approximately 11 acres of woodland were sprayed by state men about the middle of June.

Berlin

3 Infestations 163 Egg-clusters

One large colony of 154 egg-clusters was discovered in the northern end of the town near Webster Brook, extending from Berlin over the line into the southwest corner of Newington; 64 trees in mixed woodland were found to be infested and scattered over this area. This property is owned by Messrs. Sebastian and Furgerson of New Britain and Newington respectively. Another small colony was found in East Berlin on an apple tree in an orchard owned by Mr. George Dowd, where eight egg-clusters were found. The third infestation was a single egg-cluster on a roadside maple near the Stiles and Reynolds Brick Company property. The two first infestations were sprayed by state men between June 13 and June 17.

Burlington

2 Infestations 4 Egg-clusters

No new egg-clusters were found in this town this year. Three old egg-clusters were found at the 1926 infestation in the northwest corner of Burlington in woodland owned by Mr. Scheuster and another old egg-cluster was found on property owned by Mr. S. W. Coy near the Harwinton town line. No spraying was thought necessary and no further work was done in the town.

Canton

11 Infestations 323 Egg-clusters

State men started scouting in Canton on August 28 and stopped work in the town on September 18. The town was then turned over for use by the Federal men as a school for training new men. The scouting in Canton was completed by Federal forces. One large colony of 150 egg-clusters was found in woodland owned by Mr. Walter Freytag in the northern end of the town. The next largest was one of 88 egg-clusters and was found about a mile further south in pasture growth owned by Mr. Mike Bilitzke. The other nine colonies were small. Two colonies were sprayed by state men in the latter part of June.

East Granby

1 Infestation 80 Egg-clusters

One colony of 80 egg-clusters was found near the west border of the town about a mile north of Granby station. About 13 acres of woodland were sprayed at this colony between June 10 and 13 by state men.

Farmington

1 Infestation 15 Egg-clusters

A small woodland colony of 15 egg-clusters was found on property owned by the Hartford Gun Club in the northeastern corner of the town. About two acres of woodland were sprayed on June 15 by state men.

Granby

8 Infestations 115 Egg-clusters

The scouting in Granby this year consisted of scouting in the territory around last year's infestations. This was thought necessary, as the time for hatching was drawing very near and several towns were yet to be looked over. Eight infestations were found. The largest was one of 58 egg-clusters in pasture woodland margin owned by Mr. Andrew Boris of Canton, in the southwest corner of the town. Another of 15 egg-clusters also in pasture land, owned by Mr. Selden Hayes, about a mile east of the West Granby post-office, was found. These two colonies were the largest found in the town this year.

Glastonbury

1 Infestation 11 Egg-clusters

In Glastonbury, as in Granby, the work consisted of scouting around the old infestations. One colony of 11 egg-clusters was found in one oak tree and a stone wall on land owned by Mr. John Scaroni, in the eastern end of the town near the Hebron town line. This colony was sprayed by state men on June 8.

Hartland

5 Infestations 24 Egg-clusters

In Hartland the work also was confined to the territory around last year's infestations. Five small infestations with a total of 24 egg-clusters were found. The largest was one of 10 egg-clusters in a stone wall and on a fence line in the state forest north of the East Hartland postoffice.

Hartford

2 Infestations 31 Egg-clusters

The largest of these two colonies was one of 20 egg-clusters found in maple and oak trees in the northeast corner of the city; the other was one of 11 egg-clusters found on a white oak tree in the rear of 50 Forest Street, owned by Prof. L. B. Paton. Both of these colonies were sprayed on June 13 by state men.

New Britain

5 Infestations 189 Egg-clusters

The old infestation on Bassett Street was found to be re-infested again this year; 139 egg-clusters were found on 26 trees in yards along this street. Another colony of 33 egg-clusters was discovered in a block of woodland owned by Mr. Peter Soring, in the western part of the town near the Plainville town line. Four of the five colonies were sprayed by state men on the 13th and 14th of June.

Newington

1 Infestation 1 Egg-cluster

One new egg-cluster was found in Newington this year in an apple orchard in the southwestern corner of the town. This is supposed to be a natural spread from the Berlin colony which, however, reached across the line into the town of Newington. No spraying was thought necessary in this case.

Simsbury

4 Infestations 134 Egg-clusters

While scouting around old infestations, state men found four infestations in Simsbury this year. One colony of 107 egg-clusters was found on apple and hickory trees in a pasture owned

by Mr. J. L. Brown just north of the West Simsbury postoffice, another of 14 egg-clusters on a white oak tree owned by the Ensign-Bickford Company about a mile south of the Simsbury postoffice, and a third colony of eight egg-clusters in woodland owned by the Ethel Walker School, were the three largest. These three colonies were later sprayed by state men.

Suffield

1 Infestation 4 Egg-clusters

The scouting in Suffield this year, as in several other towns in Hartford County, consisted of scouting around last year's infestations. This was necessary because of the fact that the scouting season was drawing to a close and we did not have the funds sufficient to carry enough men through the year to scout these towns completely. One colony of four egg-clusters was found in Suffield in elm and willow trees on land owned by Mr. Newton Lewis of Springfield, Mass., and Dr. J. A. Gibbs, of Suffield, Conn., about two miles north of West Suffield village.

Southington

1 Infestation 212 Egg-clusters

One large woodland colony of 212 egg-clusters was found on land owned by Mr. S. T. Gridley in the southeastern corner of Southington, about two miles from Milldale postoffice. Approximately four acres of woodland were sprayed at this colony by state men on June 3.

West Hartford

2 Infestations 486 Egg-clusters

Two large colonies were found in West Hartford by state men scouting the town. The largest was found in woodland owned by the Hartford Water Works on the east slope of Talcott Mountain. Here 375 egg-clusters were found on oak, maple, hemlock and walnut trees scattered over several acres. The other was a colony of 111 egg-clusters found on one willow tree, in the southern end of the town near the Newington line. Approximately 16 acres of woodland were sprayed about the middle of June by state men.

Wethersfield

1 Infestation 791 Egg-clusters

Last year a large colony was found in Wethersfield on the banks of the Connecticut River, but owing to weather conditions it was impossible to spray this colony. Again this year it was found infested, 791 egg-clusters being creosoted on poplar, willow and maple trees owned by Mr. E. Isaacson. About 10 acres of woodland were sprayed during the early part of June by state men.

In the towns of East Hartford and Manchester, work was confined for the most part to territory known to have been infested in previous years, but no trace of the gipsy moth was found in these towns. Other towns in Hartford County where scouting was completed and no infestations found were Bloomfield, Plainville and Rocky Hill.

Middlesex County

Cromwell

1 Infestation 47 Egg-clusters

A colony of 47 egg-clusters was found in Cromwell this season by state men. This colony was in apple and white oak trees in a pasture owned by Mr. Hoffman in the northwestern section of the town, and was sprayed on June 19, 2,200 gallons of spray mixture being used.

Middletown

1 Infestation 10 Egg-clusters

A colony of 10 egg-clusters was found on one maple and one pear tree in the yard on property owned by Mr. E. H. Longworth in the southern part of Middletown, near the Durham and Haddam line. This colony was sprayed on June 6 by state men.

Middlefield

1 Infestation 418 Egg-clusters

The Middlefield colony was found in woodland owned by Mr. C. E. Lyman on the east side of the railroad where it crosses the Durham town line. About five and one-half acres of woodland were sprayed at this place on June 5 by state men.

The towns of Chester, Durham, Essex, Saybrook and Westbrook were scouted in Middlesex County, and no traces of the gipsy moth were found in any of them.

New Haven County

Meriden

3 Infestations 36 Egg-clusters

A cluster of three small colonies was discovered by state men while scouting Meriden this season. They were situated in the central part of the town. One of 23 egg-clusters on Center Street was in cherry and plum trees on property owned by Mr. Jacob Rupenthal and Mr. Majesky, and the second was on Miller Street on roadside trees containing 12 egg-clusters. The third was a single egg-cluster found in a black oak tree on property owned by the Rev. G. L. Barnes, 26 Pleasant Street. Spraying was done in this town on June 4 by state men.

Wallingford

1 Infestation 298 Egg-clusters

Last year's colony in Wallingford was found to be re-infested again this year and 298 egg-clusters were found scattered over quite a large area of woodland in the northwestern corner of the town. About 108 acres of woodland were sprayed in this vicinity; about three and a quarter tons of arsenate of lead were used. All work in this town was done by Federal men.

Other towns in New Haven County where scouting was completed were Waterbury and Wolcott. State crews did the work in these towns; no trace of the gipsy moth was found.

Litchfield County

Barkhamsted

3 Infestations 119 Egg-clusters

While scouting Barkhamsted this season, state men discovered three colonies. One of 67 egg-clusters was found in maple and oak woodland owned by Mr. C. Le Geyt, near the Granby town line about two and one-half miles east of the Barkhamsted postoffice. The second was one of 30 egg-clusters found in oak and pine woodland owned by the Hartford Water Works, about one mile south of the Barkhamsted postoffice. The third colony was also in oak and pine woodland owned by Mr. H. P. Birden and situated near the postoffice. It contained 22 egg-clusters. All three infestations were sprayed in late June by state men.

Canaan

6 Infestations 312 Egg-clusters

One colony containing 274 egg-clusters was found in woodland owned by Mr. E. D. Tracy, on the western slope of Canaan Mountain near the North Canaan town line. The other five colonies were all small, the largest containing 22 egg-clusters found in woodland owned by Mr. A. W. Krouse, about one mile southeast of the colony mentioned above. The large colony was sprayed, both scouting and spraying being done by Federal men.

Colebrook

4 Infestations 33 Egg-clusters

The work in this town was done by state men. Four small colonies were found, all of them in pastures. Two of the colonies were in the northeastern corner of the town on property owned by the Pinehurst Lakes Company and Mr. Joseph Tilles, where 22 and eight egg-clusters, respectively, were found. Another infestation of two egg-clusters was discovered in the southwestern corner of the town in a stone pile on property owned by Mrs.

H. T. Matheson. The fourth infestation was a single egg-cluster found on a pasture apple tree owned by Mr. Gus Guest, in the southeastern corner of the town just north of the Robertsville postoffice. Spraying in this town was completed June 27.

Cornwall

4 Infestations 85 Egg-clusters

All work in Cornwall was done by Federal men. The four colonies found were on land owned by Dr. W. C. Clark. Three of these infestations were on Coltsfoot Mountain; the other was in the valley between South and Howland Mountains. About 26 acres of woodland were sprayed in the early part of June at these infestations.

Goshen

When Federal men were sent to the town of Goshen to scout, they found egg-clusters hatched and larvae crawling at the infestation found last year in the woodland owned by the Waterbury Water Company. This place was scouted for larvae, but no other work was done.

Harwinton

1 Infestation 2 Egg-clusters

A small infestation of two egg-clusters was found by the state men scouting Harwinton this season. It was in an apple orchard owned by Mr. David Mansfield, about one mile north of the Campville postoffice. As both egg-clusters were whole and were creosoted, no spraying was thought necessary at this place.

New Hartford

2 Infestations 108 Egg-clusters

Two colonies were discovered in the south central part of the town about two and one-half miles south of Nepaug village. The largest was one of 91 egg-clusters found in mixed growth woodland owned by Mr. R. Surdan. The other was one of 17 egg-clusters in apple and birch growth owned by Mr. J. Perry. About two acres of woodland were sprayed at Mr. Surdan's place and one-half acre at the other colony. All work done in this town was performed by state men.

Norfolk

10 Infestations 301 Egg-clusters

One large woodland colony was found in Norfolk on land owned by Mr. James Torrant, in the northwestern corner of the town. There were three other small colonies in the same section of the town within a radius of two miles. Another cluster of colonies was found in the northwestern corner of the town, the two largest

of which contained 21 egg-clusters each; one was an orchard infestation and the other woodland, both on property owned by Mr. F. H. Toros. About 20 acres of woodland were sprayed at three of these colonies, all work being done by Federal men.

North Canaan

5 Infestations 243 Egg-clusters

Two large colonies were found in North Canaan by a Federal crew this season. One of 191 egg-clusters was in a pasture owned by Mrs. E. B. Tracy, about two miles directly south of the Canaan postoffice. Another of 42 egg-clusters was found in woodland owned by Mr. Adam Noble in the southwestern corner of the town. The other three infestations were all small, containing altogether 11 egg-clusters. About 26 acres of woodland were sprayed at two of the infestations during the middle of June, scouting and spraying being done by Federal men.

Salisbury

4 Infestations 244 Egg-clusters

Federal men while scouting Salisbury this year found a cluster of three infestations in the northeastern corner of the town on the ridge composed of Miles and Toms Mountains; all three were woodland colonies and on land owned by Mr. J. C. Roraback. The largest colony contained 54 egg-clusters; the other two 48 and 35 egg-clusters each. The fourth was a colony of 107 egg-clusters in woodland owned by Mr. J. Barkett, about one and one-half miles west of Chapinville station. Approximately 277 acres of woodland were sprayed by Federal men.

Warren

3 Infestations 124 Egg-clusters

One woodland colony of 82 egg-clusters and an orchard colony of 12 egg-clusters were discovered about a mile east of Warren village on land owned by Marshepaug Forest Club, and a third colony of 30 egg-clusters was found in woodland owned by Warren Land Company in the northwestern corner of the town. These colonies were all found by Federal men while scouting the town of Warren this season. A Federal crew in June sprayed 72 acres of woodland and 30 of apple trees in and around these three colonies.

The following four towns were scouted by state men and no infestations found: Plymouth, Thomaston, Torrington and Winchester. Towns scouted by Federal men in Litchfield County with no infestations found were the following: Bethlehem, Bridgewater, Kent, Morris, New Milford, Roxbury, Sharon, Washington, Watertown and Woodbury.

Fairfield County

Fairfield

1 Infestation 1 Egg-cluster

All the work in Fairfield County was done by Federal scouts. Only one town was found to be infested, namely, Fairfield. One new egg-cluster was found in this town on a shade tree at 74 Roanoke Avenue on property owned by Mr. A. Sewell. No spraying was done, as it was not thought necessary.

The following towns in Fairfield County were scouted and no trace of the gipsy moth was found: Bethel, Bridgeport, Brookfield, Danbury, Darien, Easton, Greenwich, Monroe, New Fairfield, Newtown, New Canaan, Norwalk, Redding, Ridgefield, Shelton, Sherman, Stamford, Stratford, Trumbull, Weston, Westport and Wilton.

Statistics of these infestations are given in tabular form on the following pages:

STATISTICS OF INFESTATIONS, 1928-29

Towns	No. infestations found	No. egg clusters creosoted	No. colonies sprayed	No. lbs. poison used	No. larvae and pupae killed	No. miles roadway scouted
New London County						
North Stonington*..	0	0	0	0	50	0
Stonington*	0	0	0	0	53	0
Groton	25	190	17	403	132	22
New London	14	490	10	417	283	13
East Lyme*	0	0	0	0	0	6
Old Lyme*	0	0	0	0	0	5
	39	680	27	820	518	46
Tolland County						
Stafford*	11	hatched	11	598	0	0
Willington*	3	"	3	250	0	8
Bolton*	1	"	1	400	0	3
	15		15	1,248	0	11
Middlesex County						
Cromwell	1	47	1	137	0	42
Middletown	1	10	1	20	10	130
Middlefield	1	418	1	180	12	36
Durham	0	0	0	0	0	27
Chester	0	0	0	0	0	38
Saybrook	0	0	0	0	0	36
Essex	0	0	0	0	0	33
Westbrook	0	0	0	0	0	36
	3	475	3	337	22	378

* Scouted around old infestations.
† Scouted by Federal men.

Towns	No. infestations found	No. egg clusters creosoted	No. colonies sprayed	No. lbs. poison used	No. larvae and pupae killed	No. miles roadway scouted
Hartford County						
Hartland*	5	24	0	0	42	12
Granby*	8	115	0	0	427	2
East Granby*	1	80	1	625	0	13 acres
Suffield*	1	4	0	0	0	3
Simsbury*	4	134	3	100	21	2
Canton†	11	323	2	125	152	68
Burlington	2	4	0	0	39	73
Avon	1	382	1	450	2	58
Farmington	1	15	1	75	20	116
West Hartford	2	486	1	775	90	93
Hartford	2	31	2	175	0	40
New Britain	5	189	4	231	25	39
Newington	1	1	0	0	0	27
Wethersfield	1	791	1	950	233	40
Bristol	0	0	0	0	0	62
Plainville	0	0	0	0	0	32
Southington	1	212	1	120	63	112
Berlin	3	163	2	712	39	77
Rocky Hill	0	0	0	0	0	46
Bloomfield	0	0	0	0	0	80
East Hartford*	0	0	0	0	0	12
Manchester	0	0	0	0	0	70
Glastonbury*	1	11	1	12	0	16
	50	2,965	20	4,350	1,153	1,080
New Haven County						
Wolcott	0	0	0	0	0	55
Waterbury	0	0	0	0	0	157
Wallingford†	1	298	1	6,600	0	131
Meriden	3	36	1	70	64	109
	4	334	2	6,670	64	452
Litchfield County						
Colebrook	4	33	1	25	34	70
Barkhamsted	3	119	3	1,025	299	60
Winchester	0	0	0	0	0	115
New Hartford	2	108	2	125	146	107
Torrington	0	0	0	0	0	127
Harwinton	1	2	0	0	0	86
Plymouth	0	0	0	0	0	74
Thomaston	0	0	0	0	0	56
Salisbury†	4	244	3	10,930	0	120
North Canaan†	5	243	2	987	0	56
Canaan†	6	312	1	100	0	67
Norfolk†	10	301	2	740	0	94
Goshen†	0	0	0	0	0	0
Cornwall†	4	85	2	1,335	0	107
Warren†	3	124	3	2,876	0	61
Sharon†	0	0	0	0	0	131
Kent†	0	0	0	0	0	100
New Milford†	0	0	0	0	0	180

Towns	No. infestations found	No. egg clusters creosoted	No. colonies sprayed	No. lbs. poison used	No. larvae and pupae killed	No. miles roadway scouted
Litchfield County—*Cont.*						
Bridgewater†	0	0	0	0	0	52
Roxbury†	0	0	0	0	0	71
Woodbury	0	0	0	0	0	104
Washington†	0	0	0	0	0	107
Morris†	0	0	0	0	0	47
Bethel†	0	0	0	0	0	53
Watertown†	0	0	0	0	0	93
	42	1,571	19	18,143	479	2,138
Fairfield County						
Sherman†	0	0	0	0	0	48
New Fairfield†	0	0	0	0	0	51
Brookfield†	0	0	0	0	0	61
Danbury†	0	0	0	0	0	99
Bethel†	0	0	0	0	0	53
Newtown†	0	0	0	0	0	187
Ridgefield†	0	0	0	0	0	97
Redding†	0	0	0	0	0	92
Monroe†	0	0	0	0	0	74
Wilton†	0	0	0	0	0	71
Weston†	0	0	0	0	0	49
Easton†	0	0	0	0	0	70
Trumbull†	0	0	0	0	0	59
Shelton†	0	0	0	0	0	105
Greenwich†	0	0	0	0	0	144
Stamford†	0	0	0	0	0	95
New Canaan†	0	0	0	0	0	72
Darien†	0	0	0	0	0	47
Norwalk†	0	0	0	0	0	144
Westport†	0	0	0	0	0	84
Fairfield†	1	1	0	0	0	175
Bridgeport†	0	0	0	0	0	201
Stratford†	0	0	0	0	0	80
	1	1	0	0	0	2,158

Summary of Statistics

County	No. towns covered	No. infestations found	No. egg clusters creosoted	No. colonies sprayed	No. lbs. poison used	No. larvae and pupae killed	No. miles roadway scouted
New London	6	39	680	27	820	518	46
Tolland	3	15	....	15	1,248	0	11
Middlesex	8	3	475	3	337	22	378
Hartford	23	50	2,965	20	4,350	1,153	1,080
New Haven	4	4	334	2	6,670	64	452
Litchfield	25	42	1,571	19	18,143	479	2,138
Fairfield	23	1	1	0	0	0	2,158
	92	154	6,026	86	31,568	2,236	6,263

Financial Statement

RECEIPTS

Appropriation for biennial period ending June 30, 1929	$100,000.00	
Rebate on automobile insurance	199.04	
	$100,199.04	
Expended, July 1, 1927, to June 30, 1928	53,043.39	
Balance available July 1, 1928		$47,155.65

EXPENDITURES

Salaries		$ 4,840.00	
Labor		34,938.85	
Stationery and office supplies		30.05	
Sundry supplies		11.31	
Communication service			
Telephone		67.55	
Travel expenses		355.99	
Gasoline		1,451.80	
Oil		476.37	
Express		1.90	
Heat, light, water and power:			
Fuel	$157.00		
Electricity	22.52		
		179.52	
Tools, machinery and appliances:			
Passenger-carrying vehicles, trucks	$1,786.00		
Other equipment	909.29		
Auto repairs	633.29		
Other equipment, repairs	19.50		
		3,348.08	
Buildings and land:			
Rent of office and storehouse and storage of cars		581.00	
Contingent expenses:			
Insurance	$553.87		
Medical services	39.50		
		593.37	
Spray materials		271.50	
			$47,147.29
Balance on hand June 30, 1929			$8.36

THE COST OF SPRAYING WOODLAND IN CONNECTICUT FOR THE CONTROL OF THE GIPSY MOTH

Roger B. Friend and Neely Turner

Woodland spraying for the control of the gipsy moth in New England has been carried on for about 30 years, and when trees can be thoroughly sprayed, the operation is highly successful. The spraying technique has been developed so that few areas are not accessible, and the high-powered pumps and solid stream

nozzles make possible the spraying of trees up to 75 feet in height at the end of a hose line 3,000 to 4,000 feet long. The degree of success attained and the cost of the work, however, depend on many factors that vary in different areas. Such factors are: the type of tree growth, the characteristics of the terrain, the extent of the infested area and its accessibility, the use of the land for grazing, and the availability of water. The woodland spraying in this state is done in an effort to prevent further spread of the insect, so many of the areas sprayed are small and isolated. In such instances, the extent of the area sprayed depends on the location of the egg masses found by the scouts.

Some estimates of the cost of spraying have been made in former years. Burgess, in 1910, stated that with the equipment then in use, one outfit and crew should be able to spray 12 acres a day at a cost of $10.00 an acre. Worthley, in 1917, estimated the cost at about five and one-half dollars an acre for large areas where it was not necessary to move the sprayer and re-lay the hose line, and stated that one crew should be able to spray 12 to 15 acres a day under average conditions, the maximum under favorable conditions with trees 60 to 70 feet tall being 21 acres. Inasmuch as the above estimates were made some years ago for areas outside of Connecticut, it was considered advisable to obtain data on the present cost per acre in this state, and to consider the various factors involved in this cost, for no two areas are exactly alike. The writers wish to emphasize the fact that extensive gipsy moth control work involves scouting, spraying, and other necessary operations, and that the work of spraying is confined to the early summer when the larvae are small and involves by no means a majority of the outlay of capital and labor.

Four infested areas in Connecticut have been studied in 1929, each of them differing from the others and each separated from the others by a distance of some miles. The first area studied is in the town of Southington; the second is in Wethersfield; the third in West Hartford; and the fourth in Avon. All were sprayed in June by the same crew of men and with the same equipment. In each case, data were obtained concerning the species of trees and shrubs present, their size, their abundance, and their distribution; the characteristics of the terrain, its slope, evenness, altitude above sea level, and the debris on the ground; the size and shape of the area, its accessibility, the availability of water; and the use of the land for grazing. The cost for each area has been estimated on the basis of actual spraying time, that is, from the time the crew begins to lay the hose until the work is finished and the hose taken up. Any delay caused by the breakdown of the sprayer or similar incident has been deducted from the time. Considerable time was consumed by traveling from one area to another and operations were held up by unavoidable diffi-

culties with the equipment. Time so used is omitted from the cost estimates, but has a bearing on this cost because it affects the total amount of actual spraying done in one season by the crew and equipment.

Equipment

Although Worthley (1917) has described the apparatus used in gipsy moth spraying, some changes have been made since the publication of his bulletin, so a brief description of equipment and supplies used in the 1929 operations is here given. For a detailed description of the pump, hose, and nozzles, the above author may be consulted.

1. *Sprayer*—A Waukesha truck (A22) with an engine rated at 90-110 horsepower, carrying a Fitzhenry-Guptill sprayer with a 400-gallon tank divided into two compartments each of 200 gallons capacity. Power for the sprayer is furnished by the truck motor. This outfit will deliver 1,000 pounds pressure at the pump and 250 pounds at the nozzle with a hose line half a mile or more long under most conditions. One compartment of the tank can be filled while the other is being emptied. Cost, $7,000 in 1918. The latest sprayer of this type is mounted on a lighter truck and may cost slightly less to operate. The machine used was loaned by the United States Bureau of Entomology, which coöperates with the state.

2. *Water pump*—A small portable one and one-half horsepower gasoline engine with a three-cylinder pump, made by the Fitzhenry-Guptil Company. This is used to pump water from a nearby source to the sprayer. Cost, $650 in 1926.

3. *Hose*—A heavy hose capable of withstanding the pressure and rough treatment to which it may be subjected. The couplings are of a special type, designed by the Federal Bureau of Entomology, that becomes tighter with increased pressure. This hose comes in 50-foot lengths and costs 75 cents a foot, couplings included. Twelve hundred and fifty feet are carried on the sprayer.

4. *Nozzle*—A "Worthley" nozzle which can be fitted with tips varying in inside diameter from one-eighth to five-sixteenths of an inch. The most commonly used nozzle for spraying tall trees has a one-fourth inch bore. For low trees, the smaller tips are used, but in any case the nozzle pressure should be maintained at 225 to 250 pounds for efficient work. Cost, $15.

5. *Accessory trucks*—Two Model T light Ford trucks were used to carry extra hose, small tools, supplies, and so forth. These trucks are used throughout the year for gipsy moth control work and no cost is estimated.

6. *Lead arsenate*—Powdered acid lead arsenate of commercial make. Cost, 12.75 cents a pound.

7. *Fish oil*—Pressed menhaden oil. Used in the spray mixture as a sticker.. Cost, 73 cents a gallon. This price was taken from the "Oil, Paint and Drug Reporter" for June 3, 1929, and is not the cost of the oil actually used.

8. *Gasoline*—Seventeen cents a gallon.
9. *Lubricating oil*—12.5 cents a quart.
10. *Crew*—1 general foreman
2 crew foremen
6 hosemen
1 nozzleman
1 mechanic and general assistant
1 truck driver

Total cost of crew per hour, $6.89.

The general foreman supervised three crews so that the cost per hour of this one man is one-third his salary. The depreciation on the sprayer, portable pump, hose, and nozzle are difficult to estimate because of the irregularity of the work, but a depreciation of 20 per cent per year on the sprayer and pump is usually charged. The depreciation on the nozzle is negligible and no charge is made for this item. Hose lasts about three years, and one-third of the cost of 3,500 feet has been charged to the 1929 season. Considering the depreciation in equipment and the fact that 96 hours of spraying were done in one year (1929), the depreciation per hour may be charged as follows:

Sprayer	$1.25
Water pump	.67
Hose	9.11
Total	$11.03

The truck undergoes considerable wear in traveling from one area to another, but this has been charged to the spraying cost. The determination of the extent of the area to be sprayed is accomplished by the scouting crew and does not enter into the cost of spraying.

Description of Areas

The primary purpose of the descriptions of the four areas sprayed is to show what kind of woodland was sprayed and what factors affect the cost of spraying, but it is of some interest to know the conditions under which the gipsy moth may become established and persist. Not only is information given, therefore, on those characteristics of site and tree growth previously mentioned (page 544) which directly bear on the cost of the spraying operation, but the brief history of the infestation from its dis-

covery to the spraying period of 1929 is included. The persistence and intensity of a gipsy moth infestation under natural conditions are largely dependent on the type of tree growth and the climate, and the presence of a relatively small number of trees, or of undergrowth and brush, on which the first two larval instars can develop, may enable this insect to become destructive over a considerable area of woodland in which the majority of economically important trees are not particularly favored as food plants. The suitability of the tree growth for the development of the gipsy moth has been determined according to the results of the work of Mosher (1915).

The areas were measured by pacing and the use of a small hand compass. In order to determine the type of growth in each area, sample plots were laid out at places suitable in size and location, and in these plots trees of one inch or more in diameter breast high were measured, counted, and listed according to species. The presence or absence of undergrowth and brush was noted. The various types of growth have been indicated on the maps of the areas. Because of the great dissimilarity in site and vegetation and the fact that on only one area, West Hartford, was there even an approximately uniform covering of trees, each infestation has been described separately. In Table 3 are the data on the number of species of trees occurring in each area. Although in the course of the investigations, all the trees were measured to the nearest half inch in diameter breast high, in the table the measurements are given in six-inch groups in order to condense the statistics. This gives as close an estimate of the relative size of the crown as can conveniently be made. In Tables 1 and 2 are given the items related to the cost of spraying and the estimated cost per acre.

1. Southington, Figure 46

The infestation in Southington comprises an area of eight acres, approximately 349,546 square feet, of fairly level land bordering the state highway about two and one-half miles south of the center of the town. The elevation drops gently from 180 feet above sea level on the south side to 160 feet on the north side. The ground is fairly wet, but not swampy, so that while spraying, the men frequently sank in water to their shoe-tops. A brook about 500 feet away furnished water. This area has been divided into seven parts, according to the types of vegetation.

(1) Four-tenths of an acre, about 18,135 square feet, rectangular in shape, on the east side of the area. Sample plot III.

All the trees in this area were tabulated. The predominant tree was swamp white oak, with American elm, red cedar, and gray birch in smaller numbers, the relative abundance of these four species being 135, 36, 26, and ten per acre, respectively. Of the

trees six inches and more in diameter, 81 per cent were swamp white oaks. In Table 3 this area has been combined with (3), which had the same type of growth.

(2) Two acres, about 83,600 square feet, rectangular in shape, west of (1).

All trees were cut off this area several years ago when an electrical power line was run through, and the land was covered

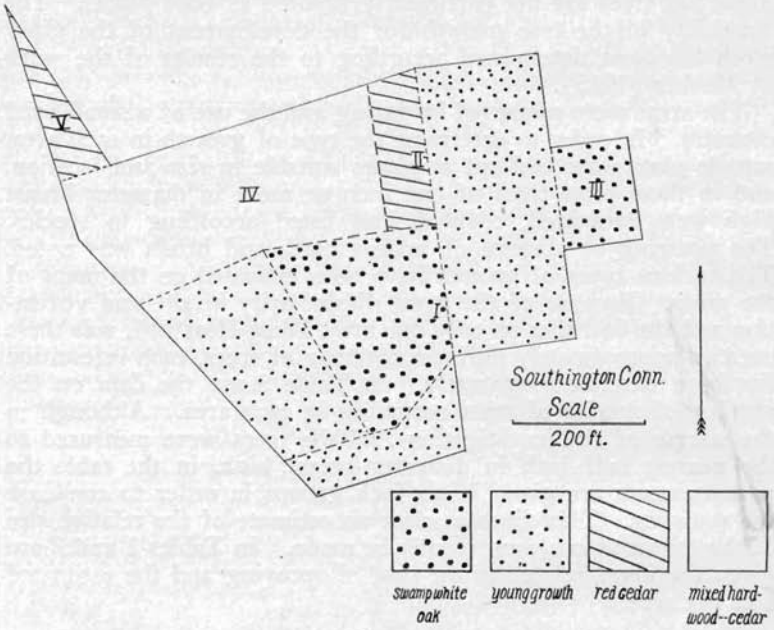

FIGURE 46. Map showing area infested by the gipsy moth in Southington, Conn., in 1929. The Roman numerals indicate the location of the sample plots. See page 547.

with alder, gray birch, red maple, and swamp white oak, growth four to six feet high. This area has been combined with areas (6) and (7), which were similar, in Table 3.

(3) One and four-tenths acres, about 59,600 square feet, irregularly pentagonal in shape, near the center of the infestation. Sample plot I, 248′ x 198′ (4,752 sq. ft.), taken along the eastern edge.

Swamp white oak was the predominating species at 342 trees per acre, followed by red cedar 198 per acre, American elm 135 per acre, gray birch 72 per acre, and apple 18 per acre. In the tabulation, this area has been combined with (1), to which it was similar.

(4a) Two-tenths of an acre, rectangular in shape, comprising 7,125 square feet, north of (3). Sample plot II, 45′ x 95′ (4,275 sq. ft.), taken along the east edge of the area.

This area was covered with red cedar, about 1,000 trees per acre. Underneath was a growth of alder brush up to ten feet in height.

(4b) Two and one-tenth acres, about 95,402 square feet, irregularly pentagonal in shape, on the north side of the infestation. Sample plot IV, 20′ x 337′ (6,740 sq. ft.), taken diagonally through the center.

This area was covered with a mixed growth that merges into overgrown pasture on the north and west. Red cedar was the most abundant species at 388 per acre, followed by gray birch at 245 per acre, swamp white oak 137 per acre, and a few elms and apple trees, but of the trees six inches and more in diameter, swamp white oak comprised 57 per cent and American elm 11 per cent.

(5) One-fourth acre, about 10,647 square feet, triangular in shape, on the northwest corner of the infestation. Sample plot 15′ x 126′ (1,890 sq. ft.), taken through the center.

This area was an old pasture growing up to red cedar that was present at the rate of 558 trees per acre.

(6) One and one-fourth acres, about 54,200 square feet, irregularly pentagonal in shape, on the west side of the infestation, densely covered with red cedar, red maple, and gray birch, up to ten feet in height with a very few scattered larger cedars and one or two large American elms and butternuts. In Table 3 this area has been combined with areas (2) and (7) which it resembled closely.

(7) One-half acre, about 23,681 square feet, irregularly pentagonal in shape, on the south end of the infestation.

This was also covered with red cedar, gray birch, and red maple up to ten feet in height and has been combined with the other areas of similar growth.

Beside the road bordering the west side of the infestation was a row of large shade trees, 67 in number and varying in diameter from three to 19.5 inches. Only thirteen of these trees are less than six inches in diameter and white ash and red cedar made up 50 of the total. These trees were all sprayed, but no area covered is estimated. The time taken to spray such a row is very small and would not appreciably affect the calculated spraying cost per acre.

Of the eight acres in this infested area, one and eight-tenths were covered principally with swamp white oak and two and one-tenth were covered with a mixed growth in which this species predominated among the larger trees. Three and seven-tenths acres were rather densely covered with young growth up to ten feet in

height and two-tenths of an acre were old pasture growing up to red cedar. Two-tenths of an acre were covered with a rather dense growth of red cedar. The species of trees and shrubs present and the history of the infestation both indicate that the gipsy moth will persist and be destructive for some time unless eliminated by control measures. Swamp white oak and gray birch, both favorite food plants, were abundant, and the focus of the infestation, as indicated by the location of the egg masses, was in the swamp white oak growth in the center. Red cedar and white ash are practically immune to serious attack. The insect was discovered in this area in the spring of 1924 when five egg masses were found, indicating that the infestation probably originated in 1923 or 1922. The area was sprayed in 1924 and was not scouted again until the spring of 1929, when 202 egg masses were found. Although this area may have been re-infested since 1924, the probability is that a few larvae survived the spraying of that year. If, as suggested by Fitch (1910), the annual increase of this insect in number is about six times, the number of egg masses found in 1929 would indicate that very few, possibly only one, females survived, mated, and oviposited in 1924.

2. Wethersfield, Figure 47

In the town of Wethersfield, the area infested comprised 40.7 acres of bottom land on the west bank of the Connecticut River, about one and one-half miles southeast of the center of the town. The land is level and, according to the height of the water marks on the trees, at times covered with four or five feet of water in the spring. The elevation is not great, being less than 20 feet above sea level. The ground was soft when sprayed but offered no great difficulties beyond the inconvenience of working in two or three inches of mud. The sprayer was able to get up to one corner of the infested area, and water was obtained from the river, which was about eight hundred feet from the machine. The tree growth in this area was of three types, and divisions have been made accordingly.

(1) The strip along the river bank, varying in width from about 114 feet to about 186 feet and comprising seven and eight-tenths acres, about 338,034 square feet, was covered with a dense growth of willows ten or twelve feet high, among which were a few small white maples.

(2) Back farther from the river and merging into the willow young growth was an area covered with white maples, varying in diameter from one to eight inches and growing in clumps of from five to nine trees each with a few elms and large willows and poplars in the northern part. The bases of the trees were covered with sediment to an undetermined depth, and this sediment is being added to each year when the land is flooded. The area covered

by this growth comprised 12.2 acres, about 522,266 square feet. Three sample plots were taken: II, 90′ x 405′ (36,450 sq. ft.), along the western border: III, 90′ x 228′ (20,520 sq. ft.), across the center, and VI, 90′ x 351′ (31,590 sq. ft.), near the east end. There were about 385 trees per acre in the area, the growth being more dense and of smaller trees toward the south and opening up toward the north where the trees are larger. Of the trees six inches and more in diameter, 73 per cent were white maples, 19 per cent willows, six per cent Carolina poplars, and two per cent elms. Inasmuch as almost all the willows and poplars were more than 12 inches in diameter, these trees furnished a greater proportion of the foliage to be sprayed than their relative abundance would indicate.

(3) The northern part of the infested area, 20.7 acres, about 901,114 square feet in extent, was covered with large white maples, Carolina poplars, and willows. There were about 88 trees per acre, most of them being more than 12 inches in diameter. Some of the large specimens measured about three feet in diameter and ranged in height from 100 to 135 feet. The three sample plots in this area were continuous with those in (2) and of the same width: I, 90′ x 588′ (52,920 sq. ft.); IV, 90′ x 381′ (34,290 sq. ft.); V, 90′ x 480′ (43,200 sq. ft.). The most abundant species was white maple, 65 per acre, but many of these were small. Carolina poplar, 13 per acre, was next in abundance, followed by willow, seven per acre, and elm, three per acre. Of the trees one to twelve inches in diameter, almost all were white maples, but of those twelve inches and more in diameter, 43 per cent were white maples, 36 per cent Carolina poplars, 19 per cent willows, and two per cent were elms.

In this infested area, the northern half, which was covered with large poplars, willows, and maples, provided suitable conditions for the gipsy moth to maintain itself. The southern half, except for the narrow strip of young willow growth along the river, was almost entirely white maple, and although the insect will feed on this plant, only a small percentage of the larvae develop. Moreover silt is laid down each year in this belt and would cover any egg masses placed close to the ground. The shore strip of willow brush is flooded so frequently that it probably would not constitute a dangerous area for any great length of time.

Control measures in this area have been very difficult. Spraying operations have not been successful because of the height of the trees and the uncertainty of the sudden flooding of the land. The most heavily infested trees, the poplars and willows, were so high that the tops could not be sprayed even with the pumps working at a maximum pressure. The land is so low that a very slight rise of the river floods it and renders spraying at this time impossible. In 1928, the crew had to leave in such a

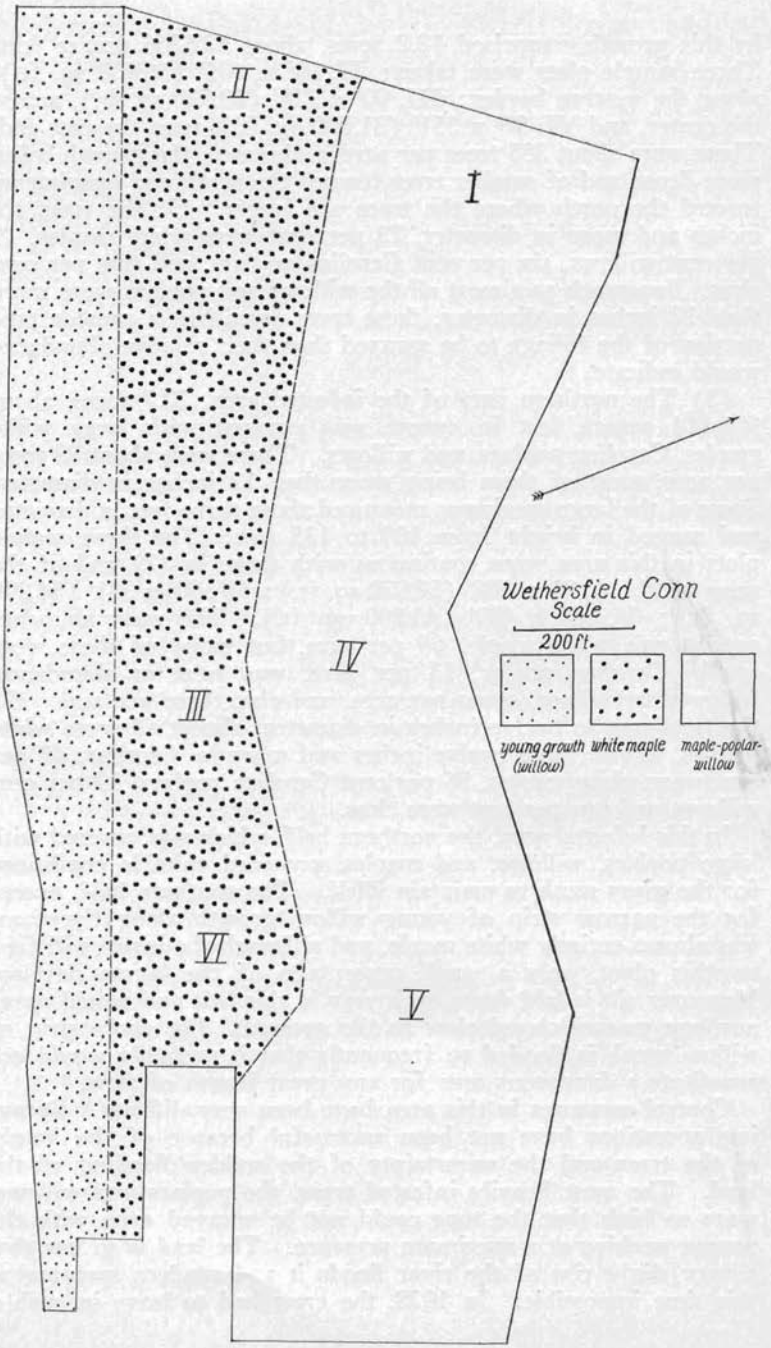

FIGURE 47. Map showing area infested by the gipsy moth in Wethersfield, Conn., in 1929. The Roman numerals indicate the location of the sample plots. See page 551.

short time that some of the hose could not be pulled out. In the fall of 1929, the number of egg masses was large in spite of the early summer spraying, and all of the ground litter, such as fallen trees and branches, was piled and burned.

The gipsy moth was first discovered here in the spring of 1928, and the trees were partly sprayed that year, work being halted because of the rise of the river, as mentioned above. Seven hundred and fifteen egg masses were found in 1928 and 791 in the spring of 1929, but thorough work was impossible in 1928 because of the spring flood. It is doubtful if the insect can ever be controlled by man in this area unless the poplars and willows are removed.

3. West Hartford, Figure 48

In the town of West Hartford, the area infested in 1929 included 22.4 acres, about 976,446 square feet, fairly evenly covered with hardwoods and hemlocks. This area is on the watershed of the Hartford Water Company reservoirs, about one-half mile east of the point where the southeast corner of Avon and the northeast corner of Farmington meet on the west boundary of West Hartford. The land is rough and slopes sharply to the east with two terraces and a deep gully. The altitude drops from 600 feet above sea level on the west to 420 feet on the east.

The tree growth was more or less typical of this part of Connecticut, and this area is the only one of the four studied which can really be considered representative of the woodland of the region. There were no open areas of old fields or pastures, and many of the common hardwood species found in this part of the state were present in more or less abundance. The eastern half of the infested area contained principally hemlock and chestnut oak to the south and chestnut oak and sugar maple to the north. The western half contained principally chestnut oak, sugar maple, white ash, red oak, hemlock and linden. Hemlock was concentrated in the center of the area and diminished in all directions. Sugar maple was rare in the center of the area and chestnut oak was rare in the northwest part. In the western and northern part of the area there was much sugar maple reproduction, and small dogwoods (Cornus), American hornbeams (Carpinus), and hop hornbeams (Ostrya), were more or less abundant. Hickory was fairly well scattered throughout and was the fourth most abundant tree. The three common species of hickory (shagbark, pignut, and mockernut) are here grouped together.

The seven sample plots taken in this area are indicated on the map and were of the following extent: I, 90′ x 129′ (11,610 sq. ft.); II, 90′ x 174′ (15,660 sq. ft.); III, IV, V, VI, and VII each 90′ x 150′ (13,500 sq. ft.). The average number of trees per acre was 392, varying from 283 in the northeast and 320 in the

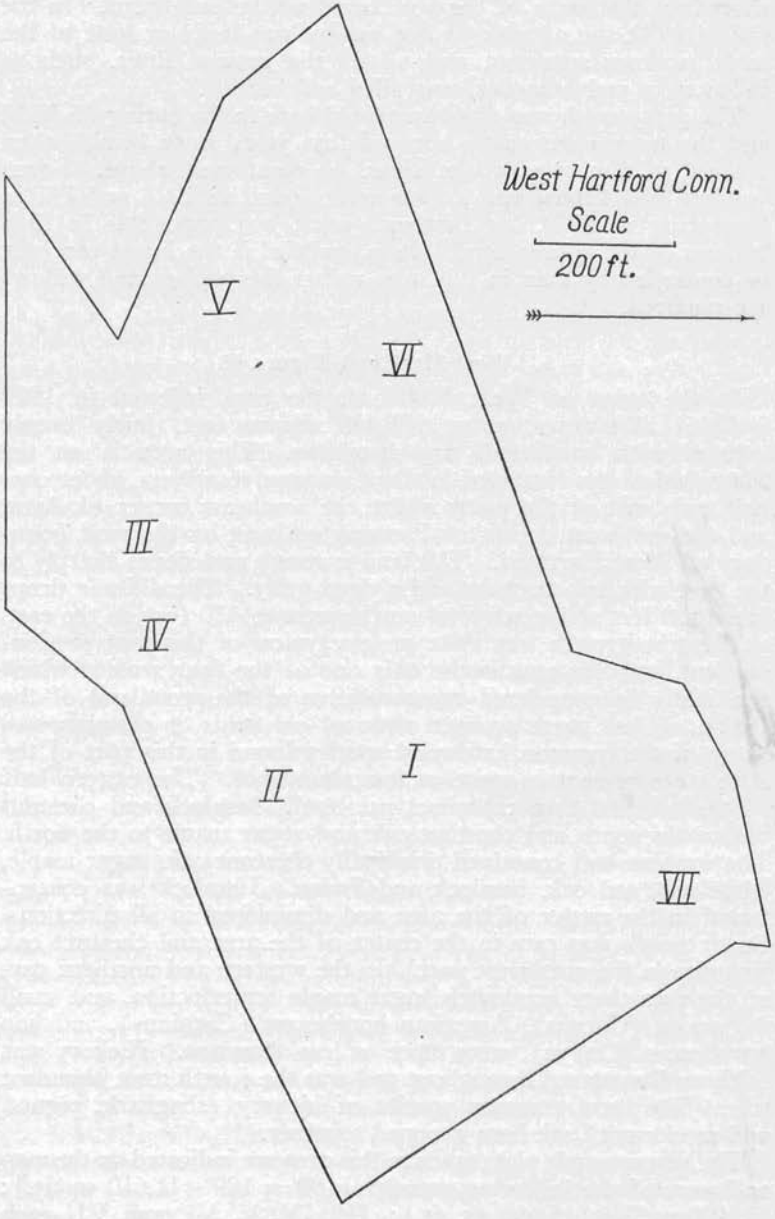

FIGURE 48. Map showing area infested by the gipsy moth in West Hartford, Conn., in 1929. The Roman numerals indicate the location of the sample plots. See page 553.

southwest to 558 in the center. Of the species present, hemlock was the most abundant, representing 24 per cent of the total number, followed by sugar maple 17 per cent, chestnut oak 15 per cent, hickory 11 per cent, white ash seven per cent, red oak five per cent, and linden five per cent. Other species were less abundant. Of the trees six inches or more in diameter, chestnut oak made up 28 per cent, hemlock 20 per cent, hickory 14 per cent, red oak ten per cent, sugar maple ten, white ash, eight, white oak, four, linden, five, and American elm, one. There was an average of 168 trees per acre of this size.

No difficulty was experienced in spraying the trees, and even though one of the men inadvertently stepped on a copperhead, the morale of the crew was excellent. The sprayer was stationed beside a brook about 400 feet away, which furnished water. A good hard road runs almost to the east border of the area.

On the basis of food plants present, this area was certainly favorable to the gipsy moth. The oaks and linden are favorite food plants; and hemlock is favored by the later larval instars. Larvae also feed to some extent on hickory and sugar maple, although if these latter species are not mixed with others more favored, they would not suffer any serious injury. White ash foliage is not eaten by the larvae.

The insect was first discovered in the spring of 1929 when 486 egg masses were found. In the winter of 1929-1930, 205 new egg masses were found. Inasmuch as the removal of the favorite food plants would mean the cutting of about 48 per cent of the best trees, such a procedure cannot be advocated. This site is a watershed for a public water supply, and expensive control measures are therefore justifiable. There is a large area of similar woodland around the infestation, which may make eradication difficult.

4. Avon, Figure 49

The area infested in Avon comprised 23.9 acres of old pasture on the western side of a ridge about one and one-half miles north of the Avon-Farmington line and about one-half mile west of the Avon-West Hartford line. The land slopes to the west, dropping from an altitude of 500 feet above sea level to 400 feet in a distance of one-fourth of one mile. Bordering the eastern edge of the infestation is a bluff about 150 feet high. To the west was overgrown pasture, but on the north, east, and south there was a growth of young hardwoods.

Seven sample plots were taken, one (II) in the brush area on the western side, 90′ x 150′, 13,500 square feet; one in each of the hardwood areas on the northeast side (III and V), 90′ x 150′; one (VIII) in the hardwood area near the western border, 75′ x 150′, 11,500 square feet; three (I, VI, and IX) in the

remainder of the area, all of which was uniformly covered with red cedar, each 90′ x 150′.

Most of the infested area, about 19.2 acres, was grassland on which was a growth of small red cedars 10 to 20 feet high, about

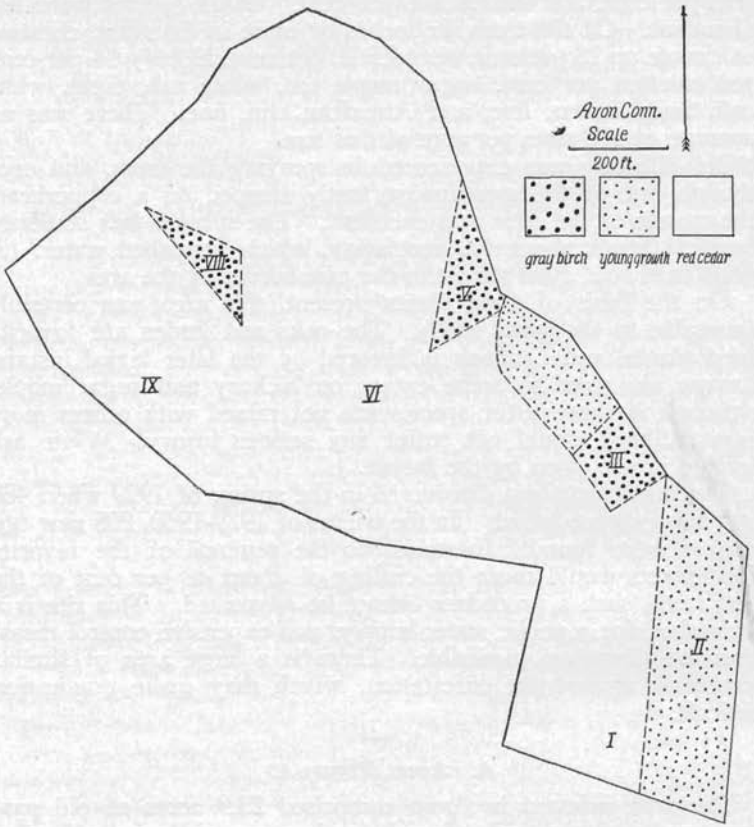

FIGURE 49. Map showing area infested by the gipsy moth in Avon, Conn., in 1929. The Roman numerals indicate the location of the sample plots. See page 555.

348 trees per acre, with a few hardwoods of small size. Along the eastern side were about 2.7 acres of young growth pasture reverting to hardwood growth, with about six large red and white oaks and sugar maples 30 to 35 inches in diameter. On the northeast side was an area of about eight-tenths of an acre of similar character. There were three small areas of young hardwoods, two on the northeast side of about five-tenths and four-tenths of an acre respectively, and one near the center of the western side of three-tenths of an acre. On the hardwood areas, which had

similar types of growth, gray birch was the predominating species, averaging about 405 trees per acre, intermixed with which were red cedars at about 66 trees per acre, hop hornbeam at about 51 per acre, black birch at about 26 per acre, American elm at about 14 per acre, and sugar maple at about 11 per acre. There were also a few red oaks, staghorn sumacs, pitch pines, white pines, hickories, red maples, tupelos, and white ashes present and an undergrowth of witch hazel. This last species was quite abundant, averaging about 139 per acre. The growth in the hardwood areas was small, only four per cent of the total number of trees, including witch hazel, which is really a shrub, being more than six inches in diameter, and only one-third of one per cent of the total number being greater than nine inches in diameter. According to the location of the egg masses, the infestation centered in the hardwood area near the western border.

The spraying of the infested area was somewhat delayed because water had to be hauled from a brook about one-half mile away. The ground was wet, due to seepage, but this did not hamper the crew either in laying the hose or in spraying the trees. The open nature of the cedar growth and the small size of the trees permitted fairly rapid work while the pump was running.

The establishment of a permanent gipsy moth infestation in this area would have to occur in the small areas of hardwoods where favorable food plants are found. The only favored food plants of all larval instars were gray birch and witch hazel, which were moderately abundant and made up much of the stand in these small areas. The red cedars, which constituted most of the growth over the entire area, are fed upon very slightly, and the probability of an infestation being established in a cedar growth is extremely remote. However, the proximity of hardwood growth, much of it favorable to the development of the insect, in the region around the infestation, and the exposure of the infested area to winds renders great the danger of spread.

The gipsy moth was first discovered here in the winter of 1928-1929 when 328 egg masses were found. In the winter of 1929-1930 seven egg masses were found, of which only three were new, that is, contained eggs laid in 1929.

The cost of spraying all four areas, the materials used, and the time necessary are summarized in Tables 1 and 2. For the Avon infestation, gasoline and oil have been computed on the same basis as for the others, even though the water was hauled. The difference between the amount used in this case and that which would have been used had water been pumped is negligible. The cost per acre varies from $11.15 in the Southington area to $21.31 in the West Hartford area. This cost is dependent on the amount of materials and time used and on the depreciation of the equipment and does not indicate the efficiency of the operation. Depre-

ciation of equipment accounts for about 50 per cent of the total cost per acre. This is due to the relatively small part of the year during which the equipment can be used.

The efficiency of the spraying operation, which in this case cannot be measured by the reduction in the number of egg masses found from year to year because the control is partly effected by treating the eggs with creosote, is indicated by the lead arsenate-time ratio in Table 2. The factors causing the variation in cost per acre are brought out in considering this ratio. The amount of foliage covered by the spray should be indicated by the amount of lead arsenate used. This represents work done. If this figure is divided by the time taken to spray the area, the result should give an index of the work accomplished per unit of time, and the higher the figure is, the more is the work accomplished, that is, the greater is the efficiency. This figure represents the facility with which work was done and has no bearing on the skill of the crew.

It is readily seen that although the cost per acre in the Wethersfield area was slightly greater than in the Southington area, nevertheless, the former area was more efficiently and hence more economically sprayed. It is also evident that although the Avon area cost less per acre than the West Hartford area, the Avon area was much less efficiently, and hence less economically, sprayed, and was, in fact, the most expensive of the four. When time alone is considered, the Wethersfield area cost least, and when foliage to be covered, as indicated by the lead arsenate used, is considered, the Southington and Avon areas are both below the Wethersfield area. The West Hartford area, which is the only one of the four covered by a woodland growth "typical" of the region, took the most time and the most lead arsenate per acre, yet the efficiency of the operation was neither the highest nor lowest, being below the Wethersfield area and above the other two.

The reason for the variation in cost per acre and efficiency of operation is due, as has been suggested previously, to the type of tree growth and the character of the site. In view of the fact that the depreciation cost depends on the time taken to spray the area, the facility with which spraying is accomplished affects this cost. At Wethersfield, the terrain was flat and the trees were easily sprayed. The ground was clear, the equipment easily handled, and the sprayer stationed beside the infestation. At West Hartford, the terrain was rough and hilly; there was much small growth under the trees, and the trees were more numerous. It is true that up to a certain extent the increase in trees per acre enables a larger amount of foliage to be sprayed per hour, but after a certain density has been attained, it is also probably true that this gain is more than offset by the difficulty in manipulating the hose line.

TABLE 1. COST OF SPRAYING WOODLAND

Infestation	Acres	Lead arsenate	Fish oil	Gallons spray	Gasoline[1]	Lubricating oil[5]	Feet hose	Time	Depreciation of equipment	Cost (including labor)
Southington	8.0	120 lbs.	none	2,400	12 gals.	1.3 qts.	2,000	4 hrs.	$ 44.12	$ 89.18
Wethersfield	40.7	950	7 qts.	15,200[2]	54.5	5.6	3,400	18.10	200.38	456.65
West Hartford	22.4	775	62	12,400[3]	61.5	6.0	2,800	20.30	226.12	477.39
Avon	23.9	450	none	7,200[4]	55.5	5.7	3,500	18.30	204.06	399.06

[1] Based on three gallons per hour for pumper and sprayer combined.
[2] 38 tanks.
[3] 31 tanks.
[4] Based on 450 pounds lead arsenate at one pound per 16 gallons of water.
[5] Based on 2.5 quarts per day for sprayer and pumper.

TABLE 2. COST OF SPRAYING WOODLAND

Infestation	Time per acre	Labor cost per acre	Lead arsenate per acre	Lead arsenate cost per acre	Per cent cost labor	Per cent cost lead arsenate	Lead arsenate—time ratio	Depreciation per acre	Per cent cost depreciation	Total cost per acre
Southington	30 min.	$3.45	15 lbs.	$1.91	31	17	.50	$ 5.52	50	$11.15
Wethersfield	27	3.00	23.3	2.90	27	26	.86	4.78	43	11.22
West Hartford	55	6.31	34.6	4.41	30	21	.63	10.12	47	21.31
Avon	46	5.33	18.8	2.40	31	14	.41	8.46	51	16.70

TABLE 3.

Infested area	Type	DBH	Trees per acre									
			Alder	Apple	Beech	Birch, gray	Linden	Oak, black	Oak, chestnut	Oak, red	Oak, swamp white	Oak, white
Southington 8 acres	(1)+(3) 1.8 acres	1–5.5″	..	14	..	51	..	..	..	..	73	..
		6–11.5	..	..	..	7	..	..	..	..	200	..
		12–17.5	..	..	..	..	..	..	..	..	23	..
		Total	..	14	..	58	..	..	..	..	296	..
	(4b) 2.1 acres	1–5.5″	..	39	..	192	..	..	..	..	28	..
		6–11.5	..	..	..	53	..	7	..	..	74	..
		12–17.5	..	..	..	..	..	..	..	..	35	..
		Total	..	39	..	245	..	7	..	..	137	..
	(4a) 0.2 acres	1–6″	..	..	..	..	..	..	..	..	..	..
	(5) 0.2 acres	1–4″	..	..	..	..	..	..	..	..	..	..
	(2)+(6)+(7) 3.7 acres	Young growth	..	..	..	..	..	..	..	..	..	..
	Roadside trees	1–5.5″	..	..	..	..	..	..	..	..	2	..
		6–11.5	..	..	..	..	..	2	..	..	1	..
		12–17.5	..	..	1	..	..	2	..	..	..	..
		18–23.5	..	..	..	..	..	..	..	..	..	..
		Total	..	..	1	..	..	4	..	..	3	..
Wethersfield 40.7 acres	(1) 7.8 acres	Young growth	..	..	..	..	..	..	..	..	..	..
	(2) 12.2 acres	1–5.5″	..	..	..	..	..	..	..	..	..	..
		6–11.5	..	..	..	..	..	..	..	..	..	..
		12–17.5	..	..	..	..	..	..	..	..	..	..
		18–23.5	..	..	..	..	..	..	..	..	..	..
		24–29.5	..	..	..	..	..	..	..	..	..	..
		30–35.5	..	..	..	..	..	..	..	..	..	..
		Total	..	..	..	..	..	..	..	..	..	..
	(3) 20.7 acres	1–5.5″	..	..	..	..	..	..	..	..	..	..
		6–11.5	..	..	..	..	..	..	..	..	..	..
		12–17.5	..	..	..	..	..	..	..	..	..	..
		18–23.5	..	..	..	..	..	..	..	..	..	..
		24–29.5	..	..	..	..	..	..	..	..	..	..
		36–41.5	..	..	..	..	..	..	..	..	..	..
		Total	..	..	..	..	..	..	..	..	..	..
West Hartford 22.4 acres		1–5.5″	..	..	..	..	9	..	10	4	..	3
		6–11.5	..	..	1	..	8	..	40	11	..	6
		12–17.5	..	..	..	..	1	..	7	5	..	1
		Total	..	..	1	..	18	..	57	20	..	10
Avon 23.9 acres	(1) 1.2 acres	1–5.5	..	..	..	399	..	..	..	1	..	..
		6–11.5	..	..	..	6	..	..	..	..	..	..
		30–35.5	..	..	..	..	..	..	..	..	..	..
		Total	..	..	..	405	..	..	..	1	..	..
	(2) 19.2 acres	1–5.5″	2	..	..	15	..	..	..	..	..	..
		12–17.5	..	..	..	..	..	..	..	..	..	..
		30–35.5	..	..	..	..	..	..	..	2	..	2
		Total	2	..	..	15	..	..	..	2	..	2
	(3) 3.5 acres	Young growth	..	..	..	..	..	..	..	..	..	..

TREE GROWTH

Trees per acre																				
Poplar, Carolina	Sumac, staghorn	Willow	Witch-hazel	Hemlock	Pine, pitch	Pine, white	Birch, black	Cherry, black	Elm, American	Hickory	Hornbeam, American	Hornbeam, hop	Maple, red	Maple, sugar	Maple, white	Ash, white	Butternut	Cedar, red	Dogwood	Total
..	..	..	..	..	..	..	..	7	59	..	7	..	..	..	..	..	..	160	..	..
..	..	..	..	..	..	..	..	..	54	..	..	..	1	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7	..	..	..	..
..	..	..	..	..	..	..	..	7	113	..	7	..	1	..	..	7	..	160	..	663
..	..	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	381	..	..
..	..	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	7	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	42	..	..	..	..	..	..	..	..	388	..	858
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1,000	..	1,000
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	558	..	558
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	1	1	1	..	..	..	..	..	3	..	5	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15	..	13	..	..
..	..	..	..	..	..	..	..	1	..	..	..	..	4	..	..	6	..	7	..	..
..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	1	..	..	..	..
..	..	..	..	..	..	..	..	2	2	1	..	..	4	..	..	25	..	25	..	67
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	5	..	..	..	..	..	..	13	..	..	..	..	..	259	..	..	..	..	..
..	..	9	..	..	..	..	..	..	2	..	..	..	..	..	77	..	..	..	..	..
2	..	9	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..
1	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	26	..	..	..	..	..	..	15	..	..	..	..	..	338	..	..	..	..	385
..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	33	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..
3	..	3	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..
6	..	2	..	..	..	..	..	..	..	..	..	..	..	..	5	..	..	..	..	..
3	..	2	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	7	..	..	..	..	..	..	3	..	..	..	..	..	65	..	..	..	..	88
..	..	..	..	64	..	..	3	..	5	19	10	15	3	50	..	16	..	..	13	..
..	..	..	..	25	..	1	..	..	1	23	..	..	..	15	..	12	1	..	..	..
..	..	..	..	8	..	..	..	..	..	..	..	..	..	1	..	1	..	..	..	..
..	..	..	..	97	..	1	3	..	6	42	10	15	3	66	..	29	1	..	13	392
..	..	..	139	..	3	1	16	..	11	4	..	50	3	7	..	3	..	63	..	..
..	1	..	..	..	2	..	10	..	3	1	..	1	..	2	..	..	..	3	..	..
..	..	..	..	..	..	..	..	..	..	1	..	..	..	1	..	..	..	..	..	..
..	1	..	139	..	5	1	26	..	14	6	..	51	3	11	..	3	..	66	..	732
..	..	..	1	2	..	..	1	..	2	..	..	..	..	1	..	..	1	348	2	..
..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	1	2	..	..	2	..	2	..	..	..	..	1	..	..	1	348	2	380
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Southington was the smallest area and the amount of time consumed in laying and taking up the hose was probably relatively greater than in the other areas. There was considerable undergrowth and the condition of the ground was far less suitable for working than in Wethersfield. This was the first area sprayed by the crew in 1929, and there may have been some delay due to inexperience with the equipment. The small amount of lead arsenate used per acre was due to the large areas of brush. At Avon, conditions were far from favorable for good work. Water had to be hauled about half a mile. The trees were small and scattered, and the hillside was irregular and rough. Although the amount of lead arsenate per acre was only slightly more than at Southington, the time per acre was half again as much. Furthermore, the sprayer was farther from the infestation than in the other areas, necessitating relatively and actually more hose laying. The conditions at Avon were such that efficient work was impossible.

As has been mentioned before, the area at West Hartford is more nearly typical of woodland conditions in this part of Connecticut than are the other areas. The cost, $21.31 per acre, is probably a good basis for estimating the cost of woodland spraying in this state. Yet conditions under which gipsy moth spraying must be carried on vary, and these conditions cause immense differences in cost. Worthley (1917) has estimated the cost as being about $5.50 per acre, about 600 gallons of spray per acre being necessary. On this basis, the lead arsenate cost, at his figure of five cents a pound for *paste,* would be $3.75 per acre and labor and other costs $1.75. At West Hartford, it cost $4.41 per acre for lead arsenate, at 12.75 cents a pound for *powder,* and 554 gallons of spray per acre were necessary. The labor cost was $6.31 per acre. Other costs were $10.72 per acre. It can be readily seen that the main difference in cost is due to the labor and depreciation charges. The West Hartford area of 22.4 acres took 20.5 hours, or about nine acres per eight hours of actual spraying. Worthley estimated 12 to 15 acres a day as an average for one crew, but does not state just what characterizes an "average acre" nor the number of men per crew and the number of spraying hours in a day. The crew for the West Hartford area is given on page 546. We have attempted to describe the areas here concerned, so that not only can an idea of the cost be ascertained, but also so that some conception of the conditions that affect the cost can be realized.

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THE SPREAD AND CONTROL OF THE EUROPEAN CORN BORER IN CONNECTICUT

W. E. Britton and M. P. Zappe

There was a marked westward spread of the European corn borer in Connecticut in 1928, 34 new towns being found infested. All except Suffield were connected with the large infestation of

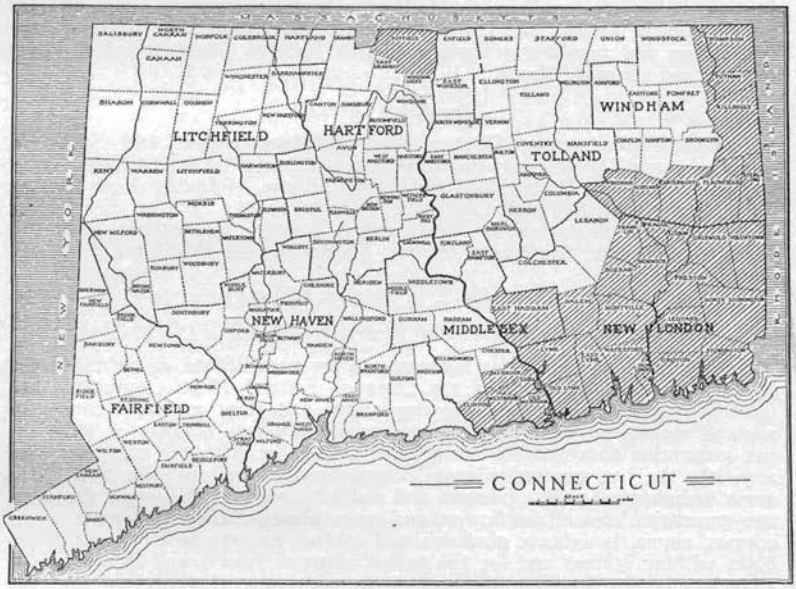

FIGURE 50. Map of Connecticut showing areas now under State and Federal quarantine on account of the European corn borer.

the double-brooded corn borer, which extends throughout Rhode Island, eastern Massachusetts, southern New Hampshire and southeastern Maine. The town of Suffield was found infested with the one-generation or single-brooded area that reaches into western Massachusetts from New York. These areas are shown in Figure 50.

After due notice and a public hearing at the Station on February 25, 1929, a quarantine order was issued in accord with Federal

Quarantine No. 43, sixth revision, effective March 1, 1929. The state quarantine became effective March 15, 1929. It is as follows:

STATE OF CONNECTICUT

AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

Quarantine Order No. 21

CONCERNING THE EUROPEAN CORN BORER

The fact has been determined that the European corn borer, *Pyrausta nubilalis* Hubn., has spread to such an extent as to make it necessary to extend the area restricted by State Quarantine Order No. 13, effective June 1, 1927, and likewise to bring it into conformity with Federal Quarantine No. 43, sixth revision, effective March 1, 1929.

Now, therefore, I, Director of the Connecticut Agricultural Experiment Station, do hereby proclaim the following towns (including those affected by Quarantine Order No. 13) to be under quarantine and subject to the restrictions and regulations made a part of Federal Quarantine No. 43, as revised, and effective March 1, 1929:

Regulated Areas

Two-Generation area: Clinton, East Haddam, Essex, Old Saybrook, Saybrook, and Westbrook in Middlesex County; Bozrah, East Lyme, Franklin, Griswold, Groton, Ledyard, Lisbon, Lyme, Montville, New London, North Stonington, Norwich, Old Lyme, Preston, Salem, Sprague, Stonington, Voluntown and Waterford in New London County; Canterbury, Killingly, Plainfield, Putnam, Scotland, Sterling, Thompson and Windham, in Windham County.

One-Generation area: Suffield, in Hartford County.

Movement of Restricted Plants

Until further notice, unless accompanied by a certificate or permit issued by an authorized inspector of the State or Federal Plant Quarantine and Control Administration, the following plants and plant materials cannot be allowed movement from the restricted areas to points outside, or from the two-generation area into the one-generation area or from the one-generation area into the two-generation area: Corn, broom corn, sorghum and sudan grass including all parts of leaves and stalks throughout the year; from the two-generation area all cut flowers and entire plants of chrysanthemum, aster, cosmos, zinnia, hollyhock, gladiolus and dahlia (except gladiolus and dahlia bulbs without stems) and for the period between June 1 and December 31, all celery, green beans in the pod, beets with tops, rhubarb, oat and rye straw as such or when used as packing.

No restrictions are placed on the movement of shelled corn in packages weighing two pounds or less; larger quantities must be certified.

This order shall take effect March 15, 1929.

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

Approved:
JOHN H. TRUMBULL, *Governor.*

This quarantine order, together with brief information about the corn borer, was published as Bulletin of Immediate Information 63, in an edition of 11,000 copies and was distributed widely

in the infested territory. The accompanying map shows the area quarantined in Order No. 21, and was printed in Bulletin of Immediate Information 63; this publication also contained information and recommendations regarding clean-up and control, as follows:

Methods of Clean-up and Control

For the past five years, the stalks, stubble and weeds have been burned in and around each separate infestation in Connecticut at the expense of the State and Federal governments, and in many cases no borers were found the next season. With the large number of towns infested, appropriations are inadequate to continue this system, and the grower must control the pest in his cultural operations. As the borers pass the winter in corn stalks, stubble and weeds, the following methods of handling the infested crop will greatly reduce the injury next season:

1. Corn stalks should be cut just as early as possible after maturity and put in the silo or fed out to cattle. When fed out, uneaten portions of stalks should be destroyed. If allowed to stand, such stalks furnish a favorable shelter for borers.
2. If cut close to the surface of the ground, very few borers will be contained in the stubble. If cut 6-12 inches high, the stubble may furnish enough borers to ruin the crop the following year, and such stubble should be plowed under cleanly, or pulled and burned.
3. Corn stalks which are not cut and used for silage or fodder should be burned in the field or cleanly plowed under. The larger weeds in the field and around their margins should also be burned.
4. By clean plowing in the fall, a large percentage of the second-brood borers are killed during the winter. Fall plowing is somewhat less effective against the single-brooded borers, but against both one-generation and two-generation borers, early spring plowing, during April, is beneficial, especially if all debris is covered deeply. There are now plows and attachments devised to facilitate the clean plowing under of standing corn stalks, and your county agent can advise you regarding them.
5. Small patches of sweet corn in back yard gardens can perhaps be pulled and burned to best advantage. If not cleaned up, such places will produce enough borers to infest the entire countryside.

Publicity

In scouting in 1928, the Federal scouts in each town worked until an infestation of the European corn borer was found and confirmed by a laboratory identification, then they moved to the next town. Consequently, it was unknown what proportion of the infestations were discovered in any given infested town. If no borers were found, the scouts examined every corn patch in the entire town. But as so many towns were found infested and not completely scouted, it was impossible for the state forces to conduct any clean-up or other control operations such as has been the practice for several years, other than distributing information and other publicity among the corn growers. It was deemed best to do everything possible under the existing conditions to prevent the spread and increase of this destructive insect. Consequently, a publicity campaign was decided upon to warn

the growers in the infested towns that the pest was present in their midst and to urge them to carry out the recommended measures of control.

In the town of Suffield and likewise in the towns on the western margin of the infested area, all of the rural districts were visited by Mr. Zappe and two Federal men during April. These men stopped at farms where they saw corn stalks and stubble still in the fields, and personally requested the owners or managers to dispose of this material as soon as possible. A copy of the quarantine and clean-up regulations was given them for reference. Where no corn was found, a copy was left at the house or in the mail box. In the infested towns east of the margin of the quarantined area, by permission of the Postoffice Department the rural mail carriers greatly assisted us by leaving a copy in each mail box along their routes. In all infested towns, the school teachers were requested to inform the children about this pest and ask their parents to dispose of all material that might contain larvae of the European corn borer. This seemed a satisfactory means of publicity as the children could easily explain to their parents the necessity for cleaning up. It was very difficult in some cases for our men to explain the matter to persons not familiar with the English language. All newspapers in the infested area assisted us by calling attention in their pages to the necessity for prompt measures of control.

This work required about 16 days each for three men, or 48 man days.

The Federal authorities had immediate charge of enforcing the quarantine regulations, and maintained a road patrol at 12 different stations on the main thoroughfares leading out of the quarantined area. At these stations considerable infested material was intercepted, containing altogether some 1,581 borers. More than half of these borers were intercepted on the Boston-New York Post Road at Station No. 12 on the Clinton-Madison town line. Illustrations of corn borer injury, plowing demonstrations and road patrol work are shown on Plates XIII, XIV, and XV.

Legislation Providing Compulsory Control

Owing to the recent rapid spread of the corn borer in Connecticut, it was foreseen that the cost of clean-up in such a large territory would be too great to be defrayed by public funds. Consequently it will be necessary for each grower to dispose of his own corn stalks and stubble. A certain proportion of growers will do this voluntarily for their own benefit, but others will not do so except under pressure. In order to make it possible to clean up all fields, the General Assembly of 1929 enacted the following law:

PUBLIC ACTS OF 1929

CHAPTER 171

AN ACT CONCERNING THE CONTROL OF THE EUROPEAN CORN BORER

Be it enacted by the Senate and House of Representatives in General Assembly convened:

SECTION 1. The director of the Connecticut Agricultural Experiment Station shall issue and publish orders, rules and regulations which shall be effective in any town or portion thereof which shall have been quarantined on account of the European corn borer as provided by chapter 31 of the public acts of 1927, which orders, rules and regulations may require that each owner, tenant or manager of land on which corn of any kind has been grown shall, not later than December first of the year of its growth, plow or cause to be plowed the field in which it was grown, so as to bury the stubble to a depth of at least six inches, or pull up and destroy such stubble or cause it to be pulled up and destroyed by burning, and each person having in his possession corn stalks shall, not later than April tenth of the year following that of their growth, completely dispose of such corn stalks by using them as fodder or by burning them, and shall destroy, or cause to be destroyed, on or before April tenth of each year, all weeds in such areas as may be designated by the director of the Connecticut Agricultural Experiment Station.

SEC. 2. Any person who shall violate any provision of this act or any order, rule or regulation issued by authority of any such provision shall be fined not more than one hundred dollars.

Approved June 3, 1929.

Difference Between the European Corn Borer and Other Burrowing Larvae Found in Corn

Each year many specimens are received from growers who find a "worm" feeding upon corn or tunneling in the stalk, and suspect it to be the European corn borer. Usually it proves to be either the stalk borer or the corn ear worm. In order that growers and others may learn to distinguish between these three insects, the brief descriptions and illustrations given below were prepared in the summer and sent to all County Farm Bureau Agents and all newspapers in the state. Many prints of the illustrations were sent in letters to correspondents. Both illustrations and descriptions were also published in *The Rural New-Yorker,* issue of October 5, 1929. Apparently most of the newspapers did not print the illustrations but many printed the descriptions.

The accompanying illustration, Figure 51, shows the European corn borer and two other common insects that are often confused with it in the public mind—all twice natural size, but showing comparative sizes and difference in markings.

The corn ear worm, *Heliothis obsoleta* Fabr., is a native American insect, very common in the southern and western states, where it is called the "cotton boll worm" and the "tomato boll worm" and where it has several generations each season. It is nearly two inches long and is distinctly striped lengthwise but varies in color

from light green to dark brown or purple. It feeds upon the silk and kernels at the tip of the ear, but sometimes works downward to the base of the ear. It is not a real borer and does not tunnel in the stalks. It is brought into Connecticut each season on early sweet corn from the south, and flights of the moths occur in September in some years. All attempts to bring it through the winter at outside temperatures in Connecticut have failed.

The stalk borer, *Papaipema nitela* Guen., is also an American species. The full-grown larva is about one and one-half inches long and distinctly striped lengthwise, one of the stripes extending forward upon the side of the head. There is also a dark girdle around the front half of the body. This borer attacks a stalk here and there and usually tunnels up or down, in the stalk,

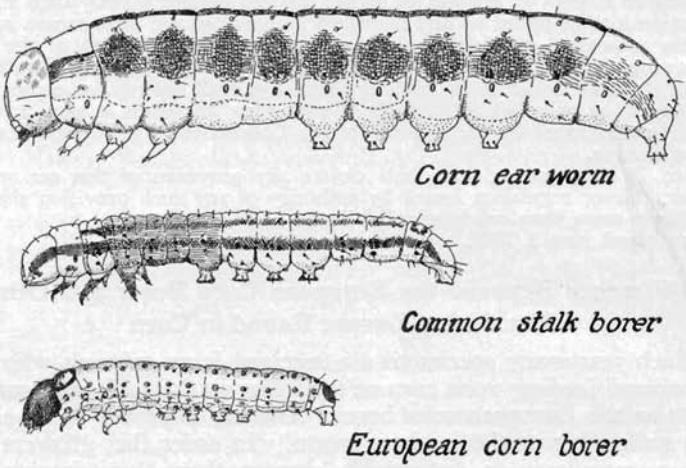

FIGURE 51. Appearance and proportionate sizes of three burrowing larvae found in corn.

but is not limited to corn and may be found in potato, tomato, dahlia, hollyhock, aster, lily, zinnia or any herbaceous stalk, even in weeds.

The European corn borer, *Pyrausta nubilalis* Hubn., has a larva an inch or less in length, white, gray, or pink in color marked with small black dots, but it is not distinctly striped. It burrows crosswise and lengthwise in the stalks, leaf-veins, and ears, including the cob, and when abundant will soon ruin the field. Though primarily a pest of corn, when the infestation becomes severe, the borers enter the stalks of celery, rhubarb, beet, bean, gladiolus, dahlia, aster, zinnia, chrysanthemum, and some of the larger grasses and weeds. This is the insect against which the quarantine was established and is now being enforced in the eastern part of Connecticut by Federal and state forces in coöperation.

TESTS OF VARIOUS APPLE SPRAYS

M. P. Zappe

Some of the fruit growers of Connecticut have been trying in many ways to eliminate the so-called spray injury, which most men believe is due to the use of lime-sulfur in combination with other spray materials. No doubt they are right; this injury to the foliage and indirectly to the fruit has become worse during the later years. Possibly high spraying pressures have contributed their share toward making this injury serious.

Other factors also have an influence on the russetting of fruit. One of these is weather conditions. Some of the fruit from the check plots that had no spray of any kind showed some russetting, though not so much as the same variety in a sprayed plot.

Various chemicals have been recommended from time to time to eliminate or to lessen the russetting and the spray injury. Iron sulfate has been used successfully for this purpose in Michigan.

We tried it last summer at the Experiment Station orchard at Mount Carmel, which contains 96 trees planted in 1911. This orchard was divided into five plots and the following spray combinations were used:

1. Iron sulfate plot:

Liquid lime-sulfur	3 gallons
Iron sulfate	1½ pounds
Black Leaf 40	1 pint
Arsenate of lead	3 pounds
Water	100 gallons

2. Liquid lime-sulfur plot same formula as the iron sulfate, except that the iron sulfate was omitted.

3. Dry lime-sulfur same as liquid lime-sulfur plot, except that six pounds of dry lime-sulfur was substituted for the liquid lime-sulfur.

4. The fourth plot was a combination plot upon which no lime-sulfur of any kind was used. This plot received the following treatment. For the pre-pink and pink sprays:

Scalecide	1 gallon
Sulfocide	½ gallon
Water	100 gallons

The calyx and later sprays were made up as follows:

Sulfocide	½ gallon
Kayso	2 pounds
Arsenate of lead	2 pounds
Water	100 gallons

All plots were given the same number of treatments, beginning with the pre-pink spray, this being followed by the pink, calyx,

7-day, two weeks, and the last spray on July 9. The varieties of apples used in the final check-up of results were Baldwin, Greening, McIntosh, and Roxbury Russet.

Appearance of Foliage During Summer

The leaves showed little injury in the early part of the spraying season. On June 10, the orchard was examined for spray injury. At this time a small amount of injury could be seen on all of the plots, most of it being on the liquid lime-sulfur plots. This examination was made before the last application of spray. Later in the season, the orchard was again examined very carefully. At this time, all plots were somewhat injured. The injury was divided into four classes: very light, light, medium, and heavy.

Iron sulfate plots—Most of the injury was considered moderate, 54%, and light, 33%.

Liquid lime-sulfur plot—Most of the injury was moderate, 50% with eight per cent in the heavy injury class.

Dry lime-sulfur plot—Most of the injury was classed as very light, 54%, to light, 33%.

Sulfocide-scalecide plot—Largest amount of injury was considered light, 50%; in the moderate injury class there was 33% and 16% of the injury was considered heavy.

Results at Harvest Time

All the fruit at time of picking was scored for insect injuries, fungous diseases, and for russetting, however slight. All fruits classed as good were entirely free from any injury except limb bruises or other mechanical injuries. The following table shows the result of the scoring of the fruit expressed in percentages:

	Iron sulfate	Liquid lime-sulfur	Dry lime-sulfur	Sulfocide scalecide	Check
Russet					
Good	75.0	73.0	66.8	48.0	8.6
Cod. moth	3.3	2.6	3.6	10.0	21.1
Curculio	13.0	19.2	24.1	37.9	74.3
Scab	.3	.1	.7	3.1	13.9
Russet	1.4	1.1	1.3	.0	.66
Other	7.6	4.4	3.9	3.8	7.0
Aphis	.0	.4	.5	.7	4.6
Baldwin					
Good	12.1	21.2	22.4	38.8	8.7
Cod. moth	6.9	3.4	2.1	1.4	34.5
Curculio	47.0	47.1	34.5	44.0	81.1
Scab	.2	.1	.2	.3	1.4
Russet	61.9	43.6	50.3	20.8	12.6
Other	4.7	2.3	2.3	2.4	5.4
Aphis	.4	.8	2.0	1.5	.7

	Iron sulfate	Liquid lime-sulfur	Dry lime-sulfur	Sulfocide scalecide	Check
Greening					
Good	37.9	59.0	60.3	68.8	11.7
Cod. moth	4.7	5.4	3.8	2.8	30.0
Curculio	44.9	22.8	31.9	23.4	79.6
Scab	1.0	.3	.7	1.1	3.7
Russet	13.0	10.3	2.1	.8	.4
Other	5.0	3.9	3.5	3.5	5.8
Aphis	.9	.2	.3	1.1	1.1
McIntosh					
Good	47.0	41.9	50.8	45.7	.16
Cod. moth	1.87	3.4	1.3	.8	8.4
Curculio	40.9	44.9	40.5	39.8	69.4
Scab	6.45	8.37	6.55	11.7	97.7
Russet	2.2	2.4	1.7	2.6	.0
Other	4.2	3.1	2.1	4.4	3.7
Aphis	.03	.02	.0	.0	.0

Summary

From a study of these figures, it would seem that the iron sulfate treatment showed no great advantage over either of the other lime-sulfur plots. The dry lime-sulfur and the liquid lime-sulfur were about equal in efficiency, but the fruit from the dry lime-sulfur plot had a better finish. The sulfocide-scalecide treatment was very good, showing a higher percentage of good fruit in three of the four varieties used in the tests. Basing the conclusions on one year's work in Connecticut, the iron sulfate has no advantage over any of the standard sprays, but needs further investigation. We hope to be able to make some further tests of sprays on apples with some modification of the spray formulas next year and to try out other promising spray combinations.

A STUDY OF VARIOUS OILS AND EMULSIONS FOR KILLING THE EGGS OF THE EUROPEAN RED MITE

Philip Garman

Extensive use of oils to control the European red mite (*Paratetranychus pilosus* C. & F.) has brought onto the Connecticut market a number of sprays that vary in composition so much that it has seemed advisable to study in detail the properties of different lubricating oils in order to lay down general principles governing their effectiveness for red mite control.

Several years ago about 20 oils were secured from different sources and submitted to the Department of Chemistry of this

Station for analysis. Mr. H. J. Fisher's report is found in part in Table 4. The oils after analysis were emulsified uniformly and sprayed systematically on marked areas containing red mite eggs, from which the dead and hatched eggs were carefully removed. Even with this procedure considerable variation occurred, so that it has been felt that some other means must be employed if direct comparison of the oils themselves is to have significance. A series of oils were therefore selected, dissolved in gasoline and sprayed upon the eggs. Four per cent oil in gasoline proved too strong, so the percentage was reduced to one per cent. The results showed some striking differences in oils of the same viscosity, which on investigation appeared to be the result of certain properties not listed in the table.

Owing to the small size of the experiment, it was repeated the following year and greater care was used in selection of eggs, spraying and handling, the eggs being subsequently hung in the open. Confirmation of the earlier experiment was not obtained, the two different oils of similar viscosity showing the same mortality within one or two per cent. It thus seems to be established that the main factor affecting kill of red mite eggs in pure oils of the types studied, lies in viscosity and not so much in properties such as sulfonation, cold test or evaporation, although there is probably not enough difference in evaporation to show in the tests outlined. There is no doubt, for instance, that mineral oils, such as kerosene or gasoline, have much less killing power than the lubricating oils of higher viscosity and lower volatility, and it is worthy of note in this connection that successive dilutions of lubricating oils with fuel oil, such as are shown in Table 6, considerably lower the toxicity. With this in mind it seems clear that oils of high evaporation and low viscosity should depend for their killing power largely on other materials contained therein or added thereto, rather than on the oils themselves.

The idea that viscosity is the main factor in the oil composing an emulsion that influences toxicity for red mite eggs, is substantiated by results shown in Table 5. It is difficult to explain the differences in the oils from different sources though it seems probable that differences in emulsifying properties may have played an important part. At any rate it is clear that with oils from the same source, those having higher viscosities were most effective.

Tests were made with two stabilized oil emulsions with lime-sulfur added and these seemed to indicate that the added lime-sulfur slightly increased the toxicity for red mite eggs.

Preliminary tests were also made in 1929 with oils emulsified differently and showing different sized globules when examined microscopically. These data are given in Table 7. The results seem to indicate that those showing the larger oil globules when exam-

ined microscopically offer the best killing agent. The more imperfectly an oil is emulsified, the larger the oil globules in general are found to be. Consequently, it seems justifiable to assume that stabilization, which usually reduces the size of the globules, also reduces its killing power. This is substantiated by the performance of commercial stabilized emulsions, which give as a rule no better kill of mite eggs than miscible oils and not so good as the homemade preparations that we have tried. However, in previous experiments where stabilization was accomplished by addition of casein, glue or gum arabic, conflicting results were obtained and further study of this phase of the question seems desirable.

In conclusion, it seems from our experiments that:

1. Heavier oils are more effective than light, when emulsified on the same formula.
2. An emulsion with large oil globules is slightly more effective than one with small globules. The differences obtained are, however, doubtfully important.
3. Fuel oil added to lubricating oils lowers their toxicity for red mite eggs.
4. Oils dissolved in gasoline may be used to compare different oils of the same or different properties.
5. There is some indication that addition of lime-sulfur to stabilized emulsions increases the kill.

TABLE 4. ANALYSES AND PHYSICAL CONSTANTS OF OILS

No.	Name	Unsulfonatable residue %	Sp. Gr. 20° C.	Saybolt Vis. 100° F.	Evaporation 60°-65° C.	Cold test
6710	XCIV (A) Sunoco Golden..	77.8	0.9450	433.8 sec.	1.69%	14° F.
6711	XCV (B) Sunoco Golden ..	75.0	0.9518	652.0	1.58	43°
6713	XCII Sunoco Golden	76.6	0.9395	195.7	2.44	—18°
6714	XCI Sunoco Golden	58.0	0.9254	103.2	5.08	—27°
6715	Aleph Oil	53.4	0.9313	291.2	2.88	21°
6716	No. 776 Oil	55.4	0.9230	704.4	1.93	41°
6717	Altair Oil	54.4	0.9342	463.2	2.05	18°
6718	Nabob Oil	54.0	0.9281	214.4	3.57	19°
6723	XXX Pale Spindle Oil	55.2	0.9257	168.8	3.88	—27°
6724	Socony Motor Oil—Medium	52.4	0.9129	443.3	0.85	16°
6725	Socony Motor Oil—Heavy..	39.6	0.9148	915.4	0.73	18°
6726	Socony Motor Oil—Light...	62.4	0.9073	291.4	1.26	10°
6727	No. 14 Spray Oil	56.0	0.9306	604.0	1.77	27°
6728	No. 910 Spray Oil	56.4	0.9280	472.7	1.69	16°
6729	Alcopol Oil	56.2	0.9201	222.2	3.22	7°
6730	XXV Sun Spindle Oil	51.2	0.9265	168.0	2.71	—20°
8214	Marcol	92.8		90.0	1.38	
8213	Acto	97.8		331.4	1.71	

TABLE 5. TESTS OF VARIOUS OILS EMULSIFIED ON A TWO PER CENT BASIS, FOR KILLING POWER FOR EGGS OF THE EUROPEAN RED MITE

Analytical number of oil	Viscosity	Hatch per cent	
Socony lubricating oils, automobile			
6726	291	40.0	
6724	443	13.7	
6725	915	19.9	(poorly emulsified)
Sun Oil Co., lubricating oils			
6714	103	54.5	
6713	195	51.0	
6710	433	47.5	
6711	652	20.0	
Texas Co., oils			
6718	214	31.0	
6717	463	17.6	
Gulf Refining Co., oils			
6729	222	19.0	
6728	472	15.7	
6727	604	14.8	
Standard Oil Co., white oils			
8213	90	14.9	
8214	331	4.8	

Formula: 75 cc. oil
25 cc. water
2 gms. sodium oleate powder

Diluted 10.6 to 400 cc. water

TABLE 6. EFFECT OF ADDING FUEL OIL ON THE KILLING POWER OF A LUBRICATING OIL; TWO PER CENT EMULSION

Analytical number of oil used	Per cent fuel oil	Dates of treatment and exam.	Total eggs	Number hatched	Per cent hatched
6715	50	3/1–5/16	123	30	24.6
6715	33	3/1–5/16	259	56	21.6
6717	25	3/1–5/16	507	59	11.8
Check		3/1–3/16	77	43	55.5

TABLE 7. TESTS OF KILLING POWER OF DIFFERENT OILS, DISSOLVED IN GASOLINE, ON THE EGGS OF THE EUROPEAN RED MITE; ONE PER CENT LUBRICATING OIL USED[1]

Analytical number of oils used	Viscosity	Average per cent hatched	Total number counted	Dates of treatment and exam.
6711	652	9.8	322	4/23–5/16
6710	433	4.7	347	4/23–5/16
6714	103	29.7	256	4/23–5/16
6716	704	6.0	292	4/23–5/16
6718	214	6.8	487	4/23–5/16
6723 } 6730 }	168	19.5	739	4/23–5/16

[1] Laboratory tests. Sprayed and kept in jars over saturated salt solution.

TABLE 7—*cont.*

Check—			
no treatment	81.5	161	4/23–5/16
Gasoline only	58.5	326	4/11–4/23–30
Check—			
no treatment	70.5		4/11–4/23–30

TABLE 8. COMPARISON OF TWO OILS DISSOLVED IN GASOLINE, THE OILS HAVING THE SAME VISCOSITY BUT SLIGHTLY DIFFERENT PROPERTIES[1]

Viscosity of oil	Total eggs used	Number of tests	Average per cent hatched
168	2153	13	34.0
168	3339	20	32.9
Gasoline only	1204	8	46.4
Check—no treatment	1305	10	61.3

TABLE 9. EFFECT OF VISCOSITY ON KILLING POWER OF OILS, 1929[2]

Analytical number of oil	Viscosity	Number of eggs	Number of tests	Per cent hatched
6714	103	3637	23	15.7
6713	195	851	6	11.8
Check—no treatment		1390	9	35.0

TABLE 10. COMPARISON OF UNSTABLE EMULSION FORMING A FILM ON SURFACE QUICKLY, WITH STABILIZED EMULSION IN WHICH SEPARATION IS DELAYED[1]

Number of eggs used	Number of tests	Per cent hatched	
1423	9	1.6	Unstable: Visc. 200, 2% oil
1520	9	4.1	Stabilized: Visc. 100, 2% oil, April 4
1125	7	8.5	Stable: Visc. 100, 3% oil, March 14
1114	8	7.7	Unstable: Visc. 100, 3% oil, March 14
464	5	59.0	Check—no treatment

TABLE 11. COMPARISON OF EMULSION WITH LARGE OIL GLOBULES WITH ONE HAVING SMALLER GLOBULES[1]

Number of eggs used	Number of tests	Per cent hatched	
990	6	3.9	Unstable: Globules 5-8 μ, few below 5 μ, oil visc. 100
1090	7	4.8	Stabilized: Globules .8 μ-6.8 μ, none above 6.8 μ, mostly below 5, visc. 100
841	5	60.5	Check—no treatment

TABLE 12. SHOWING EFFECT ON RED MITE EGGS OF ADDING LIME-SULFUR TO TWO COMMERCIAL STABILIZED EMULSIONS

Oil	Oil content	Lime-sulfur dilution	Number eggs used	Number tests	Per cent hatched
A	4%	None	1504	10	4.2
A	4%	1–50	1554	10	3.0
B	4%	None	1979	10	3.8
B	4%	1–50	1265	10	.55

[1] Sprayed and hung outside exposed to the weather.
[2] Sprayed and hung outside exposed to the weather. 1.5 per cent oil. Emulsified with sodium oleate plus casein, using the same formula for each. Higher viscosities gave no better results than the 195 sec. oil in this test.

EXPERIMENTS WITH OILS ON A DOUBLE INFESTATION OF APHIDS AND EUROPEAN RED MITES AT THE EXPERIMENT FARM AT MOUNT CARMEL

Philip Garman

An opportunity to try different combinations for control of aphids[1] and red mites was afforded in 1929 by a double infestation of the two species at the Experiment Station Farm. In addition to field tests in which a number of large trees were treated with each material, eggs were clipped from the trees, sprayed in the laboratory and hung outside. Counts were made first of the number of eggs hatching, second of the per cent killed on the trees and finally of the number of colonies of aphids establishing themselves. Counts were also made of red mites and the number of spurs becoming infested. Two brands of oil were used, a heavy miscible oil and a commercial emulsion with ammonium caseinate.

At the time of the application, the leaves of Greening and Baldwin were well advanced, and in consequence some burning occurred, especially with the oil emulsion, though this was not serious with any of the mixtures. In addition to the two oils alone, the emulsion was combined with free nicotine and nicotine sulfate and the count showed considerably improved results with these combinations for aphis control over the oil alone. The oil plus lime-sulfur seemed to increase the leaf burning, although no serious harm resulted and there was a good crop of fruit on these trees. The commercial oil was also combined with freshly made Bordeaux with good success from the standpoint of spray injury, there being little or no injury and the trees recovering promptly. The Bordeaux mixture was made by dissolving copper sulfate, pouring the material into the tank and filling it to about two-thirds capacity, then slaking granular lime[2] on the strainer and washing this into the tank. The oil was then emulsified in a small amount of water and added to the tank. The oil lime-sulfur combination was not so successful and considerable sludge settled to the bottom.

The best control of aphids was obtained with the lime-sulfur and nicotine-sulfate spray, Table 14, the combination of oil and nicotine, either sulfate or free nicotine, ranking next. Very little difference could be seen in the two latter combinations, which differ somewhat from the New Jersey results, but may be explained by the fact that the oil used contains considerable free ammonia, which probably acts on nicotine sulfate to free the nicotine rapidly, thus making this combination essentially the same as the oil and free-nicotine mixture. The miscible oil showed considerably greater kill than the commercial oil emulsion, but less than oils plus nicotine. Unfortunately there were few or no

[1] Mostly green aphids, *Aphis pomi* De G.
[2] Difficult to slake by this method in cold weather.

aphids on the trees sprayed with lime-sulfur and oil or Bordeaux and oil so that corroboration of laboratory results particularly with oil-lime-sulfur, as given in Table 13, could not be obtained. The various oils are ranked in the order of the best kill for aphids in Table 15.

TABLE 13. RESULTS IN CONTROL OF APHIS ON APPLE, 1929[1]

Tests to Kill the Eggs

Materials	Dilution	Per cent killed
Lime-sulfur Nicotine sulfate	1–10 1–400	97.5
Oil (emulsion) Lime-sulfur	4–100 1–100	88.8
Oil Free nicotine	4–100 1–800	67.3
Oil Nicotine sulfate	4–100 1–800	65.2
Oil without nicotine or lime-sulfur	4–100	64.3
Check—no treatment—sprayed clear water		43.3

TABLE 14. COUNT OF APHIDS ON SPRAYED APPLE TREES

Materials used	Dilution	Per cent aphis infested spurs
Lime-sulfur Nicotine sulfate	12 gals.–100 gals. 1 pint – 50	7
Oil emulsion Nicotine sulfate	5 gals.–100 1.5 pints–100	22
Oil emulsion Free nicotine	5 gals.–100 1.5 pints–100	26
Miscible oil	4 gals.–100	27
Miscible oil Bordeaux	4 gals.–100 8–8 lbs. –100	39
Miscible oil Lime-sulfur Casein lime	4 gals.–100 3 gals.–100 3 lbs. –100	43
Oil emulsion	5 gals.–100	54
Check	No treatment	58

TABLE 15. VALUE OF SEVERAL DIFFERENT TREATMENTS COMPARED IN ORDER[2] FOR KILL OF APHIDS

	Kill of eggs	Kill of aphids in field	Infestation of fruit spurs	
1	LS—N.S.	LS—N.S.	LS—N.S.	
2	Oil—Free N.	Oil—N.S.	Oil—N.S.	very close in all
3	Oil—N.S.	Oil—Free N.	Oil—Free N.	tests
4	Oil only	Miscible oil	Miscible oil	approximately the
5		Oil emulsion	Oil emulsion	same in field tests
6	Check	Check	Check	

[1] Mostly green apple aphis (*A. pomi*). A few rosy aphis. Eggs treated in laboratory and hung outside.

[2] Omitting oil Bordeaux and oil-lime-sulfur sprays. No. 1, best; 2 next; 3, next, etc.

TABLE 16. SUMMARY OF RESULTS IN SPRAYING EXPERIMENTS FOR CONTROL OF APHIS AND RED MITES IN A COMBINED INFESTATION AT MOUNT CARMEL, 1929

Materials	Dilution	Per cent[1] aphis killed	Per cent[2] spurs infested with aphids	Per cent[3] red mites killed	Per cent[4] spurs infested by red mites
Lime-sulfur ... Nic. sulfate ...	12 gals.–100 gals. 1 qt. –100	75	7	Few or no E. red mites on these trees at the beginning	
Oil emulsion .. Free nicotine ..	5 gals.–100 1.5 pints–100	59	26	96.3	33
Oil emulsion .. Nic. sulfate ...	5 gals.–100 1.5 pints–100	64	22	92.4	17
Miscible oil ...	4 gals.–100	44	27	Few or no E. red mites on these trees at the beginning	
Oil emulsion ..	5 gals.–100	44	54	88.1	39
Miscible oil ... Lime-sulfur ... Casein lime	4 gals.–100 5 gals.–100 3 lbs. –100	42	43	91.4	12
Check		35	58	30.5	99

NOTES ON LIFE HISTORY AND CONTROL OF THE PINE LEAF SCALE

Neely Turner

The pine leaf scale, *Chionaspis pinifoliae* Fitch, is a pest of considerable importance on young pine trees in Connecticut. Heavily infested seedlings grow slowly, lose much of their foliage, and are killed if the attack persists. Older trees growing in shaded locations are also very susceptible to attack and are sometimes seriously injured. Infested foliage becomes light in color, and the trees are very sickly in appearance, even when the infestation is comparatively light. The pine leaf scale attacks many species and varieties of pine, and has been recorded as attacking spruce in other states. However, there are no Connecticut records of this insect on spruce. It is also found on hemlock, *Tsuga canadensis,* when grown both as trees and as hedges. Infested hemlock hedges lose foliage badly, and occasionally branches are killed. Illustrations of this insect are shown on Plate XXIV.

Although this is a very common insect, very little work on life history and control has been done. Earlier notes on the subject almost uniformly stated that there were two broods a year, and suggested kerosene emulsion as a control. Later publications call attention to the use of dormant oil and lime-sulfur sprays. The

[1] Counted on twigs removed from the trees and brought to the laboratory.
[2] Counted in the field; more than 1,000 spurs examined for each treatment.
[3] Twigs clipped off and counted in laboratory with microscope.
[4] Counted in field, using only spurs with eggs on them or at their bases.

most recent study was published by Herrick, who found that in central New York the pine leaf scale has but one brood a year. He suggested the use of oil sprays applied after the crawlers had hatched, as a control measure.

The following notes on life history and control of this insect were made at New Haven during 1929. All observations were made on young Scotch pines, *Pinus sylvestris,* six years from seed. These seedlings are planted in the open and not shaded.

There were two distinct broods of this insect in 1929. Crawlers from the over-wintering eggs first appeared on May 18 and a majority of the eggs hatched during the succeeding week. Very soon after hatching, the crawlers settled down and started feeding. A few days after feeding began, the young larvae changed in color from the dark red of the newly hatched crawlers to a straw color. The bodies increased in size rapidly, but molting did not begin until June 12. Thus the young larvae remained unprotected for a period of about three weeks. The first brood matured early in July and by July 10 practically all the second brood eggs were laid. Two weeks later, a few second brood crawlers appeared, but all the eggs did not hatch until August 12. At this time, many of the young larvae had already molted. The over-wintering eggs were deposited during the first half of October. There was no indication that any of the first brood eggs carried over until fall.

Control Measures

Dormant applications of liquid lime-sulfur or miscible oil have been recommended frequently for control of this pest. However, the insect is very resistant to sprays at this time, the eggs being well protected by the covering of the old female scale. Oil sprays at two per cent actual oil content applied April 29 failed to give good control. Approximately 40 per cent of the eggs were killed, the natural mortality being about 10 per cent. The oil used was a laboratory preparation—a soap emulsion of a white oil.

The comparatively long period of time between hatching of the first brood eggs and the first molt, first noted by Herrick, suggested contact insecticides for control at this time. Accordingly, tests were made, using oil sprays and commercial 40 per cent nicotine sulfate with soap. The oil spray was a laboratory preparation containing one per cent white oil emulsified with soap. The first application was made May 18, before all the eggs had hatched. Most of the larvae and a few of the eggs were killed by this spray. A second application, May 25, effected a more complete control. Applications of 40 per cent nicotine sulfate, diluted one part to 500 parts water with one per cent soap flakes, were made on May 20 and 25. These sprays also gave good control, killing all of the crawlers, but very few of the eggs.

In both cases, the first application was made before all the overwintering eggs had hatched and therefore complete control was not obtained by the first spray. It is believed that the second application was much more important than the first. The trees in this experiment remained free from insect injury without further treatment. No injury was noticed from the oil application.

Spray tests were also made on second brood larvae, although the prolonged period of hatching of this brood makes control difficult. A commercial white oil spray was used at one per cent actual oil content. This oil was a low-viscosity white oil, about 60 seconds Saybolt. Application was delayed until July 26, at which time about half the eggs had hatched. This one application gave very good control, all the crawlers being killed and most of the unhatched eggs as well.

Nicotine sulfate was applied at one part to 500 parts water with one per cent soap, July 26 and August 3. These sprays killed the young crawlers, but did not affect the unhatched eggs. A third spray was not applied, but would have been necessary for complete control.

Oil Sprays on Evergreens

Summer oil sprays have not been tested extensively on evergreens, and should therefore be used with caution. No injury resulted from the experimental applications made in this test, but injury to evergreens has been reported from other states. A few precautions should be taken into account in applying oil sprays to evergreens. Only sprays made from highly refined (white) oils should be used during the growing season. Oil sprays should not be applied during excessively hot weather or during drought.

Recommendations for Control

Wherever possible, all sprays to control this insect should be made on the first brood. Nicotine sulfate, one part in 500 parts water with one per cent soap, or white oil at one per cent should be applied about June 1 in southern Connecticut. This date varies with location and seasonal differences. However, the red crawlers are very easily seen, and spraying can be timed about ten days after they first appear. If sprays for the second brood are desired, one application of a white oil at one per cent, or two applications of nicotine sulfate, one part in 500 parts water, with one per cent soap, should be made. In southern Connecticut the oil spray should be applied about August 1, and the nicotine sprays about August 1 and August 15. Based on appearance of the crawlers, the oil spray or first nicotine spray should be applied about a week after the first crawlers appear, and the second nicotine spray two weeks after the first application.

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THE MEXICAN BEAN BEETLE IN CONNECTICUT

***Epilachna corrupta* Mulsant**

A new pest of vegetable crops has appeared in Connecticut in the Mexican bean beetle, *Epilachna corrupta* Muls., which was discovered in July in the western portion of the state by Dr. E. P. Felt, Director of the Bartlett Tree Research Laboratories, at Stamford. The presence of this pest in the state was brought to the attention of the writer in a letter received from Doctor Felt on July 15. On July 23, the writer visited the Bartlett Laboratories in North Stamford and saw specimens of this insect and its injury in a bean patch near the Laboratory.

Present Distribution in Connecticut

Thus far, the insect has been noticed only in the western half of the state; it has been observed in Fairfield, New Haven, Litchfield and Hartford Counties.

The first records were received from Doctor Felt; then specimens were received from correspondents. Members of the department staff observed the insect in two towns and finally Mr. Rodney Cecil, of the Bureau of Entomology, made a hurried trip through a portion of the state and discovered the pest in a half dozen localities. These localities, with date and name of the observer, are given below:

Fairfield County:

Brookfield, July, E. P. Felt
Darien, July 26, B. H. Raymond
Monroe, Aug. 9, R. C. Botsford
New Canaan, July, E. P. Felt
Ridgefield, July, E. P. Felt
Sherman, Aug. 1, C. L. Johnson
Stamford, July, E. P. Felt
Westport, July, E. P. Felt
Wilton, July, E. P. Felt

Litchfield County:

Canaan, Sept., R. Cecil
Salisbury, Sept., R. Cecil
Washington, July, E. P. Felt

New Haven County:

Meriden, Sept., R. Cecil
New Haven, Sept., R. Cecil
Orange, Aug., R. B. Friend
Wallingford, Sept., R. Cecil

Hartford County:

Hartford, Sept., R. Cecil

In all the localities mentioned above, the infestations were light with only slight feeding upon the leaves. Mr. Cecil expressed his opinion in a letter to the effect that these "infestations originated from a few scattered egg-masses probably from migrating adults this Spring."

Mr. Zappe and his men were requested to watch for this insect on bean patches when traveling about the state inspecting nursery stock, but the pest was not discovered in any other towns in Connecticut.

History in the United States

Mexico is believed to be the original home of the Mexican bean beetle, but the insect has been known to be present in the southwestern part of the United States for more than 75 years. It now exists in Arizona, Colorado, New Mexico, western Texas, and Utah. In 1920 this insect was discovered in northern Alabama, and is thought to have been introduced in shipments of alfalfa hay from the West during the World War.

From Alabama, the Mexican bean beetle has spread chiefly northward and eastward until it now occupies Tennessee, Kentucky, Indiana, southern Michigan, southern New York, and all territory between these and the Atlantic Ocean. Southward it has spread more slowly; and now covers the upper two-thirds of both Alabama and Georgia, nearly all of South Carolina and the northeastern corner of Mississippi. Isolated infestations have been discovered in southern Georgia near the Florida line and at six points in Ontario, Canada, north of Lake Erie and Lake Ontario.

Injury to Plants

The plants are injured because the leaves are partially devoured by both larvae and adults; the feeding is chiefly from the under side. The adults generally feed upon the lower surface in ragged areas, but often eat through the upper surface. The larvae have the habit of feeding in small definite areas, eating narrow, nearly straight, parallel channels close together with a thin ridge of tissue between, and leaving the upper surface intact. These channels and ridges reach across the small area, and may be parallel with, perpendicular to, or at an angle, in relation to adjoining areas. In other words, the ridges do not all run in the same direction; some of them run in the same direction as the principal veins, and others are perpendicular to them. Between, there are all possible gradations in direction. This injury, therefore, presents a very characteristic appearance, as shown on Plate XXII, and could hardly be mistaken for the work of any other insect. Where the insects are abundant, bean plants are soon destroyed.

Food Plants

The Mexican bean beetle feeds upon the leaves of beans, preferring the common garden and field bean and the Lima bean to other plants. It will attack and injure all varieties of pole and bush beans of the genus *Phaseolus*. As a second choice, it will subsist upon the wild beggar-weed or beggar-ticks, *Meibomia* sps., cowpea, soy bean, hyacinth bean, alfalfa, and sweet clover.

Importance as a Pest

This insect is a serious pest of beans in the greater portion of this area in the eastern states. It is possible that the insect has about reached its northern limit; that it may not continue its rapid spread northward, and that it may not multiply as rapidly or do as much damage in Connecticut as in other states further southward. It is reported that the spread of the Mexican bean beetle in Michigan in 1929 was insignificant.

Description and Relationship

The adult beetle is about one-fourth of an inch long, longer than broad, and has the smooth, hard, hemispherical shell characteristic of the lady beetles, family Coccinellidae, to which it belongs. In color it is pale brown or buff and each wing cover bears eight black spots, which vary considerably in size and shape. In certain specimens the spots are so large that they almost coalesce. On emerging, the beetles are lemon yellow, but graduaally darken until they become copper color. In size, they are smaller than the squash lady beetle, *Epilachna borealis* Fabr., and have smaller spots. The thorax of the Mexican bean beetle is unmarked and that of the squash lady beetle is spotted.

The eggs are laid in masses of 40 to 60 on the under sides of the leaves. They are small, about one-twentieth of an inch long and orange in color. The larvae, when fully grown, are about one-third of an inch long, orange in color and covered with long branched spines. The pupae are about the same size as the beetles, yellow, and are attached to the leaf or other object upon which they pupate, the cast larval skin with spines covering the last abdominal segments.

The Mexican bean beetle, *Epilachna corrupta* Muls., and the squash lady beetle, *Epilachna borealis* Fabr., are the only lady beetles in Connecticut that feed upon cultivated plants and are injurious. All other species prey upon small insects and are considered beneficial.

Natural Control Agencies

Several native insects feed upon the eggs and larvae of the Mexican bean beetle. One of these is the spotted lady beetle,

Ceratomegilla fuscilabris Muls., which eats both the young larvae and eggs. The "anchor bug," *Stiretrus anchorago* Fabr., in both the nymph and adult stages, feeds upon the larvae, pupae and adults. The spined soldier bug, *Podisus maculiventris* Say., attacks the bean beetle in all its stages. The insects mentioned above all occur in Connecticut and are the chief insects that prey upon the Mexican bean beetle, though there are other lady beetles and other bugs which sometimes feed upon it.

Two species of two-winged flies occurring in Connecticut have been reared in Alabama as parasites of the Mexican bean beetle, *Phorocera claripennis* Macq., and *Helicobia (Sarcophaga) helicis* Towns., and a third species, *Paradexodes epilachnae* Ald., is a prevalent parasite in certain sections of Mexico.

Artificial Control Measures

As a means of control for the Mexican bean beetle, spraying or dusting has proven the most successful. Calcium arsenate seems to be more effective than lead arsenate and has been generally recommended by those who have gained experience in controlling the pest. One of the most satisfactory remedies is to dust the plants with calcium arsenate or magnesium arsenate, using one pound of the dry poison in four pounds of hydrated lime. Another formula is calcium arsenate, one pound, fine dusting sulfur, one pound, and hydrated lime, four pounds, using from 12 to 15 pounds per acre. Sodium fluosilicate, one part in two parts of lime, may also be used as a dust. As a spray, magnesium arsenate, one pound in 50 gallons water, has given good results when applied at the rate of about 100 gallons per acre. On string or snap beans where the pods are to be eaten, it is advisable to spray with a pyrethrum-soap preparation, following the directions on the package.

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FULLER'S ROSE BEETLE IN CONNECTICUT

Pantomorus godmani (Crotch) = *Aramigus fulleri* Horn

On September 5, Mr. Johnson of this department brought to the office some weevils from a greenhouse in Norwalk. These beetles were upon the blossoms of *Acacia,* and were said to have eaten notches in the leaves of the *Camellia,* several varieties of which were growing there.

These beetles were identified by Mr. Walden as Fuller's rose beetle, *Pantomorus godmani* (Crotch), a species formerly listed as *Aramigus fulleri* Horn, and considered a pest of roses and some other plants. Some of the books and bulletins of a generation ago contain accounts of this insect. Smith's "Insects of New Jersey" in reference to this insect contains the following statement: "An imported species, which was for a time a serious pest in rose-houses in Union County and elsewhere. It was never abundant outdoors and is rarely found now, even in greenhouses, where they have learned to deal with it."

Later, some curculionid larvae were dug from the soil in the same greenhouse in Norwalk and brought to the Station, but at this writing, no adults of Fuller's rose beetle have been reared from them. The only adults so far obtained are the black vine weevil, *Brachyrhinus sulcatus* Fabr.

Distribution, Food Plants and Habits

According to Doctor Chittenden,[1] this insect occurs over the greater portion of the United States and Canada. In the northern range it appears in greenhouses, but in California it is known to live out of doors. The food plants recorded are as follows: abutilon, achyranthes, alfalfa, apple, apricot, azalea, common and Lima beans, begonia, blackberry, camellia, canna, cape jasmine, carnation, cissus, citron, chrysanthemum, currant, deutzia, dracaena, fuschia, geranium, golden glow, grapefruit, hibiscus, leadwort, lilies, lemon, oaks, orange, palms, peach, pear, pentstemon, persimmon, plum, plumbago, prune, primrose, potato, raspberry, roses, scabiosa, strawberry, sugar cane, tangerine and vinca.

Apparently roses, especially tea roses, are preferred with geranium a second choice. In California it occasionally causes injury to lemon groves, and the larvae feed upon the roots of blackberries, loganberries, raspberries, roses and strawberries.

The beetles feed at night, and during the day rest in places where they are not readily observed, usually among the leaves of their food plants, but sometimes clinging to the twigs or hiding under the plants. They are active at night, but they have no wings and cannot fly; hence, they must crawl up the stems to reach the leaves. When disturbed, they fold their legs and antennae and drop to the ground after the manner of the plum curculio and many other weevils. As they do not move for some time and are inconspicuous in color, they readily escape notice.

Life History

The female lays eggs in crevices or under the edges of loose bark near the ground, in flattened batches containing from 10 to 60 eggs arranged in several contiguous rows. Sometimes the eggs are deposited between the soil and the main stem. These eggs adhere together firmly. They hatch in about a month, and the larvae live in the soil, where they feed upon the roots of plants. The length of the larval stage has not been definitely determined but probably occupies a month or more and varies considerably, according to the conditions under which the insect exists. In fact, it is said that all stages may be found during the winter and early spring, but that the individuals are most noticeable in December.

Description

The adult beetle varies from a quarter to three-eighths of an inch in length. The snout is short and scarred at the sides of the mandibles. Head, thorax and abdomen are brown, more or less covered with gray scales. These scales are somewhat lighter on

[1] F. H. Chittenden, Division of Entomology, Bull. 27 (new series), 88. 1901.

the head and thorax and browner on the abdomen. The abdomen is oval, longitudinally ribbed or striated, and with a diagonal patch of light gray scales near the outer margin of each wing-cover, about half-way between the base and apex. Legs and antennae are nearly uniform in color with the thorax and abdomen. See Plate XXVI, a.

Methods of Control

It is said that the beetles live a long time and are very resistant to the usual insecticides. Even hydrocyanic acid gas has little effect on them at a concentration that is safe for the plants. Persistent searching for the beetles and killing them, during the months of November and December, greatly reduces the number of the insects and has practically eradicated the pest from many greenhouses. Another measure of control is to kill the larvae and pupae by treating the soil with carbon disulfide or an emulsion of carbon disulfide. As the beetles are wingless, they must necessarily crawl up the stems to gain access to the leaves, and this fact may be taken advantage of to protect the plants by placing around the stems, barriers of cotton, card collars, or tanglefoot to prevent the beetles from ascending the plants.

Essig recommends spraying the foliage with lead arsenate, two pounds of the dry powder in 50 gallons of water, where the bands cannot be used.

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AN OUTBREAK OF SMALL AQUATIC FLIES IN A FILTER PLANT

B. H. Walden

At the request of Mr. C. P. Prann, city engineer of Meriden, a visit was made July 30 to the filter plant of the Meriden Water Company at South Meriden, where swarms of small non-biting

flies were causing trouble in the control room. The plant was operated at night because the electrical power could then be obtained at a reduced rate. The insects were attracted to the lights and had badly spotted the black panels of the instrument boards, as well as the white walls of the room. They were also very annoying to the operator in charge of the plant. In the morning, a pint or more of these flies could be swept from the floor under the lights. Screens had been put in the windows, but the flies readily came through the mesh and many that would naturally fly out again were held in by the screens, so that there were probably more flies inside in the morning than there were before the screens were put on.

A few larvae and pupae were present in the water in the filter beds and adults were emerging in the coagulating tanks where the water was received before it passed to the filter beds. It was evident from the method of handling the water that it did not remain long enough for the flies to breed in either place.

The reservoir, about 1,000 feet away, was then examined. Many larval and pupal skins were floating on the surface of the water near the edges. Although it was quite evident that the flies were breeding in the reservoir, it was not determined why they were so much more abundant than in any preceding season. There had been a lack of rain, but the water level was within a foot of normal. It was suggested to try suction fans near the electric lights to rid the control room of them.

Some of the flies were collected and found to represent two species; these were sent to Professor O. A. Johannsen, of Cornell, who determined the species as *Chaoborus punctipennis* Say. and *Chaoborus trivittatus* Loew, of the family Culicidae. The former, a spotted species, was very abundant, but the latter formed only about four or five per cent of the total number of flies.

THE JAPANESE BEETLE: SCOUTING AND QUARANTINE ENFORCEMENT

W. E. Britton and J. Peter Johnson

In 1929, the work of controlling the Japanese beetle in Connecticut has been carried on as a coöperative project by this department and the Federal Plant Quarantine and Control Administration. This work has consisted of (1) soil treatment to kill the grubs, (2) trapping and scouting for beetles, and (3) quarantine enforcement.

Mr. Johnson has been in immediate charge of all this work and the report in detail has, for the most part, been prepared by him.

Soil Treatment

From numerous diggings in the localities where Japanese beetles were found in 1928, it was ascertained that grubs were present in the soil. Therefore, it was deemed best to treat these areas both in Hartford and New London in an attempt to kill the grubs before they could transform and emerge as beetles. With Federal coöperation, this work was carried out between May 31 and June 8. A quantity of prepared standard carbon disulfide emulsion was purchased. This emulsion was diluted at the rate of 1.2 quarts in 50 gallons water and applied by means of an automobile truck spray outfit. Treated areas are shown on Plate XVIII.

In Hartford eight men working six days treated an area of 107,200 square feet of lawn surface, using 40,200 gallons of diluted emulsion. In New London, seven men in two days treated 27,200 square feet, using 10,200 gallons. These figures are shown in the following:

Place	Date	Diluted emulsion applied (gallons)	Area treated sq. ft.	No. men
Hartford	May 31–June 6	40,200	107,200	8
New London ..	June 7–8	10,200	27,200	7
Total		50,400	134,400	

Scouting

The scouting activities in Connecticut began on July 8, 1929, when 29 men reported at the Shelton office ready for work; in the next few days, five more men reported, making 34 men in all, in addition to the scout supervisor. These men were taken to Bridgeport, where they were trained by the supervisor and two other men who are permanently connected with the project. They remained there for several days until the supervisor was satisfied that they were qualified for scouting. They were then divided into seven field scouting crews of four men each, and two greenhouse scouting crews of three men each. Each crew was then assigned a definite territory and work began in the following localities: a crew each in Hartford, Manchester, Meriden, New Britain, New London, Wallingford and Willimantic. The state had been divided into approximately 16 areas, each area being of such a size that it was possible for the field scouting crews to cover the entire ground without being removed from their headquarters. Upon completing one area, the crew was moved to another and in this way the work was carried on more efficiently and with the minimum waste of time in travel. The supervisor visited the crews daily, assigning the areas to be scouted and checking over the work performed. It was also his duty to see that all records of scout work were completed properly, and he kept close contact between the headquarters office and the various crews.

The greenhouse scouts inspected all classified establishments within the regulated area. In order to do this, the men were divided into two crews of three men each and a motor car was assigned to each crew. One crew was sent to the regulated area in Fairfield County, and the other to that area within New Haven County. The classified establishments and the routes were so arranged that each establishment was scouted twice every week during the entire season.

Throughout the season, scouting was also performed at various times in Bridgeport, Norwalk, New Canaan, New Haven and Stamford by farm products inspectors. This was done to enable the department to keep informed as to the increase in the degree of infestations at these places, also as to the possible spread of beetles from these established infestations.

There were 290 crew hours lost on account of rainy weather, though the rainfall was below normal, causing a dry and dusty condition throughout the season.

The areas scouted during the 1929 season included the following towns, villages and cities:

Berlin
Branford
Bridgeport
Bristol
Canaan
Cheshire
Clinton
Colchester
Collinsville
Cromwell
Danbury
Danielson
Deep River
East Hampton
East Hartford
East Windsor Hill
Enfield
Forestville
Guilford
Groton
Hartford
Hazardville
Lakeville
Litchfield
Lyme
Madison
Meriden
Middletown
Milldale
Manchester
Naugatuck
Norfolk
Norwich
New Britain
New Haven
New London
New Milford
Oakville
Plainville
Plantsville
Pomfret
Portland
Putnam
Salisbury
Saybrook
Southington
Stafford Springs
Stamford
Stratford
Stonington
Suffield
South Manchester
Terryville
Thomaston
Thompsonville
Torrington
Wallingford
Waterbury
Watertown
Warehouse Point
Westbrook
Westerly, R. I.
West Hartford
Willimantic
Windsor
Windsor Locks
Winsted

In addition to the daily scouting for *Popillia japonica* Newn., *Anomala orientalis* Waterhouse, and *Aserica castanea* Arrow, night scouting was carried on for the *Aserica castanea* Arrow by the foremen of each crew. This work was carried on between the hours of 7:00 P. M. and 10:00 P. M., two and three nights a week as the weather permitted, each man carrying a flashlight. However, in this scouting no beetles were found.

The areas scouted at night during the 1929 season included the following towns and cities:

Bridgeport, Bristol, Canaan, Cromwell, Fairfield, Hartford, Middletown, Meriden, New Britain, New Haven, North Manchester, Putnam, Stafford Springs, Stamford, Torrington, Wallingford, Willimantic, Winsted.

Japanese beetle traps furnished by the Federal men were placed around the infestations of 1928, in Hartford and New London before the beetles emerged, and allowed to remain until September 15. Traps were placed in Willimantic and in additional localities in Hartford, as soon as possible after the beetles were discovered. The number of traps used in each place and the number of men required to attend them is shown in the following table:

City	No. of traps	No. of men
Hartford	750	3
New London	250	1
Willimantic	250	1
Total	1,250	5

Asiatic and Japanese beetles were found at the following places outside of the 1928 generally infested area.

HARTFORD

Address		Beetles found	Dates found
70 Fairfield Avenue	1	*Popillia japonica*	July 31
88 Fairfield Avenue	1	" "	July 31
603 Farmington Avenue	1	" "	July 31
107 Grandview Terrace	1	" "	July 31
115 Grandview Terrace	1	" "	July 31
125 Beacon Street	1	" "	Aug. 13
Ford and Asylum Streets	12	" "	Aug. 13
36 Bodwell Street	1	" "	Aug. 27
Total Hartford	19		

WILLIMANTIC

Address		Beetles found	Dates found
49 Maple Street	2	*Popillia japonica*	Aug. 5
7 Turner Street	1	" "	Aug. 5
17 Turner Street	1	" "	Aug. 3
13 Turner Street	2	" "	Aug. 3
13 Turner Street	3	" "	Aug. 5
Total Willimantic	9		

HARTFORD

In traps	413	*Popillia japonica*	June 9 to Sept. 14
Near traps	450	" "	June 9 to Sept. 14
Total Hartford	863		

New London			
In traps	95	*Popillia japonica*	June 9 to Sept. 14
Near traps	73	" "	June 9 to Sept. 14
Total New London	168		
In trap	1	*Aserica castanea*	June 9 to Sept. 14
Willimantic			
In traps	4	*Popillia japonica*	June 9 to Sept. 14
Near traps	8	" "	June 9 to Sept. 14
Total Willimantic	12		

Total number of towns in which beetles were found 3

Total number of beetles found outside of generally infested area of 1928: *Popillia japonica,* 1,043; *Aserica castanea,* 1.

In all, 80 classified nurseries and greenhouses were scouted twice a week in the summer of 1929.

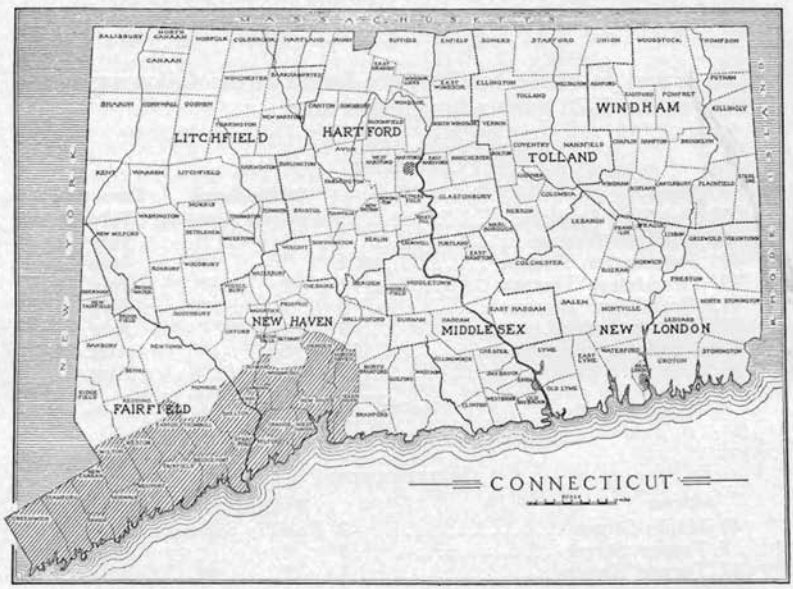

FIGURE 52. Map of Connecticut. Shaded areas indicate territory quarantined on account of Japanese beetle.

Quarantines

On account of the distribution of the beetle, Federal Quarantine No. 48 (Fifth revision) extends the Bridgeport area to include New Haven and surrounding towns. The state quarantine coincides with the Federal Quarantine (Figure 52), but places addi-

tional restrictions on certain areas in Hartford and New London, as shown in Figures 53 and 54. The quarantine order follows:

STATE OF CONNECTICUT

AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

Quarantine Order No. 20

CONCERNING THE JAPANESE BEETLE

The fact has been determined that the Japanese beetle, *Popillia japonica* Newman, has been found in the cities of New Haven, New London and Hartford, and to prevent the further spread of this pest it is necessary to extend the quarantine restrictions over certain additional areas regarding which a public hearing was held in New Haven, February 25, 1929. Federal Quarantine No. 48 has also been revised, effective February 15, 1929, to include eleven additional towns in New Haven County.

Now, therefore, I, William L. Slate, Director of the Connecticut Agricultural Experiment Station, under authority conferred by Chapter 31, Public Acts of 1927, do hereby proclaim the regulated area fixed by State Quarantine Order No. 16, and by the rules and regulations supplemental to Federal Quarantine No. 48 (Fifth Revision), effective on and after April 1, 1927, as amended effective on and after November 1, 1927, namely, the towns of Bridgeport, Darien, Easton, Fairfield, Greenwich, New Canaan, Norwalk, Shelton, Stamford, Stratford, Trumbull, Weston, Westport, and Wilton, in *Fairfield County,* to be extended to include the eleven towns of Ansonia, Derby, East Haven, Hamden, Milford, New Haven, North Haven, Orange, Seymour, West Haven and Woodbridge, in *New Haven County.*

Also, that that portion of the City of Hartford bounded by Farmington Avenue, Spring Street, Walnut Street, Sargeant Street, and Sigourney Street, is hereby quarantined.

Also, that that portion of the City of New London bounded by Huntington Street, Bristol Street, Williams Street, Manwaring Street, Hempstead Street, Franklin Street, Cottage Street, and Broad Street, is hereby quarantined.

The rules and regulations supplemental to Federal Quarantine No. 48 (Sixth Revision), effective on and after February 15, 1929, or any subsequent amendments thereto, restricting the interstate movement of quarantined articles from the regulated areas, are hereby declared to be in full force and effect with respect to the intrastate movement of quarantined articles from the herein designated regulated areas of Connecticut to unregulated portions thereof.

This order shall be effective on and after April 1, 1929.

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

Approved:
JOHN H. TRUMBULL, *Governor.*

The foregoing quarantine order with maps and brief information about the Japanese beetle was published as Bulletin of Immediate Information 64, April 15, 1929, in an edition of 6,250 copies.

Inspection of Farm Products

In making a preliminary survey as to the market conditions in the shipping centers that would be affected by the Farm Products Quarantine, it was necessary to erect platforms in Bridgeport and

New Haven. It was also necessary to station a man in Norwalk, one in Stamford and have one ready at the Shelton office to take care of inspections. The platform at Bridgeport was located on Water Street, near the center of the market, and approximately ten by thirty feet, while the one in New Haven was located at 21 Lafayette Street, being similar in size. The New Haven platform was also located to advantage in the market. It was found,

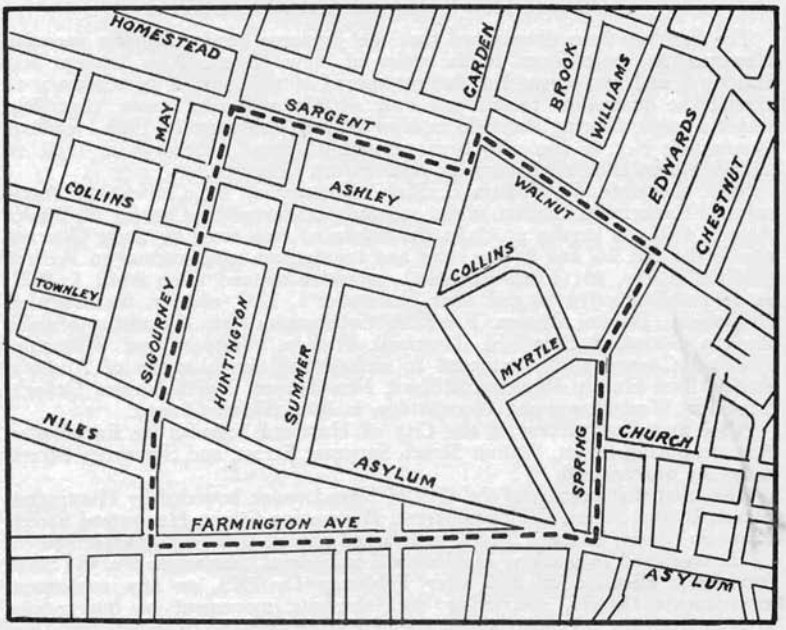

FIGURE 53. Map of section of Hartford. The dotted line surrounds area under State quarantine on account of Japanese beetle.

however, as the season progressed, that the size was inadequate and if conditions are similar in the coming year, it will be necessary to enlarge it somewhat.

The one foreman located at New Haven, in addition to his duties at the inspection platform, also took care of miscellaneous inspections that were made at other points from that section. Six inspectors were employed and the platform was open throughout the week from Sunday afternoon, 3 P. M. through Saturday until 5 P. M. As the New Haven market carried on most of its own business at night, it was necessary to have the majority of the men present at those hours. Only one man was at the platform during the daytime, from 7 A. M. to 3 P. M. Another inspector reported at 3 o'clock and was on duty until 11 P. M. At 8 P. M., a second

inspector reported and he made inspections at chain store headquarters for two or three hours every night because it was found to work out more efficiently. He generally returned to the platform about 10:30 or 11:00 o'clock and remained there until 4 A. M. At 11 P. M. two inspectors reported for work. Thus three men were present at the platform at the rush hours. These were from 11:45 P. M. to 2 A. M. and from about 4:30 A. M. until 7 A. M. The sixth man reported at 1 A. M. and worked

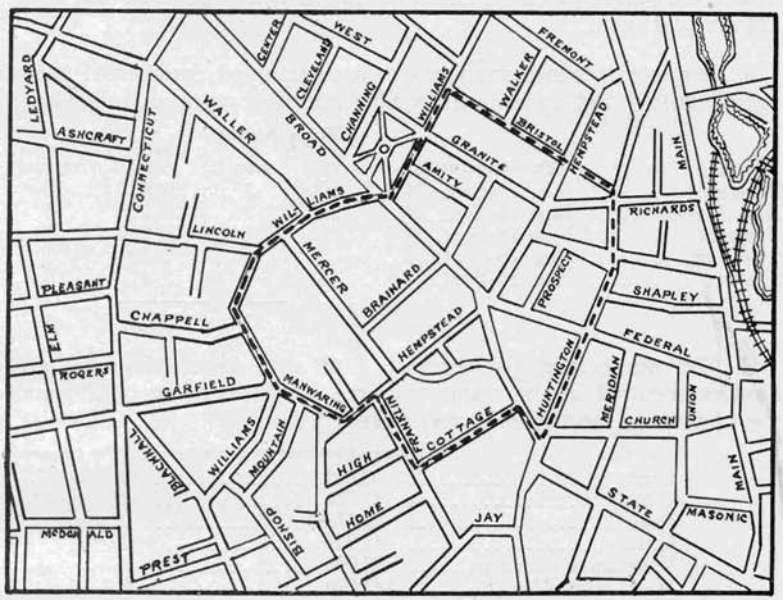

FIGURE 54. Map of section of New London. The dotted line surrounds area under State quarantine on account of Japanese beetle.

until 9 A. M. It was found that this schedule of the inspectors reporting for work took care of the inspections in an excellent manner.

The Bridgeport platform was open from 6:30 A. M. until 5 P. M. with the exception of Saturday afternoons and Sundays. One man reported at 6:30 A. M. and worked his eight hour shift; the other man reported at 9 A. M. On the busy mornings, which occurred Mondays, Thursdays and Fridays, the foreman reported at 6:30 A. M., thus giving adequate service to the shippers. When periods were slack during the day he checked the inspectors at Norwalk and Stamford and took care of miscellaneous inspections elsewhere.

One man was stationed at the Berman and Steinberg commis-

sion house, Norwalk, while the other man was located at the S. Cohen and Co. commission house at Stamford, by arrangement. These men reported at 6 A. M. and worked eight hours. All inspections requested in those sections were referred to one of the two men. On quiet days these inspectors scouted the known infestations and the area surrounding them, to determine the increase in number of beetles present and their possible spread.

The inspector at the Shelton office took care of all miscellaneous inspections and was used as an extra on heavy days at the New Haven platform.

1. Inspection points, number of men employed, number of packages certified and number of beetles removed were as follows:

Place	Period operated	Hours per day open	Number of men	Packages certified	Beetles removed
Bridgeport	June 17–Sept. 24	10½	3	54,577	0
New Haven	June 21–Sept. 24	24	7	474,297	1
Norwalk	June 18–Sept. 24	8	1	23,996	0
Stamford	June 18–Sept. 24	8	1	3,299	3
Shelton	June 15–Sept. 24	8	1	412	0
			13	556,581	4

2. The number of packages of fruit and vegetables, and cut flowers certified in the regulated area of Connecticut, 1929, and the number of beetles removed were:

Article	Number of packages	Number of beetles removed
Corn	10,853	0
Beans	43,794	1
Peas	12,475	0
Lettuce	43,049	0
Vegetables with tops	88,790	0
Misc. vegetables	142,670	0
Misc. fruit	180,934	3
Bunches bananas	34,016	0
Boxes cut flowers	827	0
Total packages	557,408	4

3. The number of bales of hay, straw and sphagnum moss certified for shipment from the regulated area of Connecticut during 1929 were:

Office	Bales hay	Bales straw	Bales moss	Total bales
Shelton	178	80	0	258

4. Roads posted with quarantine signs, 1929, 66.

5. During the farm products quarantine, a total of 22 men were employed in patroling the roads at the quarantine boundaries. See Plate XVII.

6. Number of vehicles carrying quarantined articles without certification.

Roads	June	July	August	September	Totals
Post Road at Branford	51	111	92	40	294
Middletown at North Haven	..	16	16	1	33
Meriden at North Haven	3	37	21	9	70
College Highway at Hamden	17	30	32	..	79
Bethany at Woodbridge	2	28	12	5	47
Waterbury at Seymour	9	14	26	13	62
Bethel-Easton	5	22	12	..	39
Wilton-Ridgefield	4	1	..	..	5
	91	259	211	68	629

7. Number of vehicles bearing quarantined articles intercepted at the quarantine line each month and the season total.

Roads	June 18-30	July 1-31	August 1-31	September 1-14	Totals
Post Road at Branford	242	1,558	1,597	403	3,800
Middletown at North Haven	..	98	69	12	179
Meriden at North Haven	8	962	1,153	249	2,372
College Highway at Hamden	48	500	641	114	1,303
Bethany at Woodbridge	22	387	295	77	781
Waterbury at Seymour	67	468	430	123	1,088
Bethel-Easton	53	280	292	..	625
Wilton-Ridgefield	..	123	91	18	232
	440	4,376	4,668	996	10,380

Inspection of Nursery and Ornamental Stock

1. Within the quarantined area are 119 classified establishments having 642,280 square feet of glass and 1,333 acres of nursery stock.

2. Plants certified for shipment each month.

Jan.	Feb.	Mar.	Apr.	May	June	July
70	299	85,812	110,082	89,952	155,270	48,162

Aug.	Sept.	Oct.	Nov.	Dec.	Total
15,536	19,738	18,630	37,162	4,888	585,601

3. Diggings to determine grub infestations in fields, frames, or treated plots.

During the spring and fall of 1929, men were employed in making diggings to establish the fact whether or not any of the Asiatic beetle grubs were present in nurseries within the state.

Grubs were found in nurseries in the following towns:

Township	No. of grubs, *Aserica castanea*
Cromwell	25
Manchester	10
Mansfield	1
New Canaan	2
Southport	2
Total grubs found	40

4. During the season of 1929, 28 classified concerns decided to drop their classification because all of their business was within the regulated area.

Sand, Soil, Earth, Peat, Compost and Manure

1. Car loads of sand and manure certified for shipment out of the regulated area of Connecticut, 1929.

Sand	Manure	Total
360.5	136	496.5

2. The number of certificates issued on shipments of sand and manure.

Material	'A'	'F'	'G'	Total
Sand	609	3	51	663
Manure	84	..	..	84
	693	3	51	747

Summary

1. Average number of men employed in each different branch of the quarantine work at Connecticut office, each month, during the year 1929.

SHELTON OFFICE

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Scouting	0	0	0	0	0	0	20	29	8	0	0	0
Farm products	0	0	0	0	0	20	34	31	12	0	0	0
Nursery and greenhouse	2	2	2	4	20	17	8	10	8	21	20	5
Administrative	2	2	2	2	2	3	1	1	1	1	1	1
	4	4	4	6	22	40	63	71	29	22	21	6

2. Total number of each kind of certificates used on shipments of (A) nursery and ornamental stock, (B) sand, soil, peat, marl, etc., (C) manure, (D) hay and straw, (E) fruit and vegetables, and (F) cut flowers, in State of Connecticut from January 1 to December 31, 1929.

Kind	Farm produce	Cut flowers	Hay and straw	Nursery and ornamental	Sand, soil peat, etc.	Manure	Total
'A'	....	....	24	1,218	609	84	1,935
'B'	11,931	....	....	....	....	....	11,931
'C'	58	....	....	....	....	....	58
'D'	....	....	....	1,036	....	....	1,036
'E'	....	526	....	11,729	3	....	12,258
'F' blanks	....	....	....	193	....	....	193
'G'	....	301	....	489	51	....	841
'H'	5,678	....	....	....	....	....	5,678
	17,667	827	24	14,665	663	84	33,930

3. Articles certified, and number of beetles removed, in the State of Connecticut, January 1 to December 31, 1929.

Total packages farm produce	556,581	Beetles removed	4
" boxes cut flowers	827		
" bales hay and straw	258		
" plants certified	585,601		
" C. L. sand, soil, etc.	360.5		
" C. L. manure	136		

4. Total certificates lost or unaccounted for, 116.

5. Violation of Federal regulations totalled 26 in 1929; one case was prosecuted. The state prosecuted and obtained convictions in two cases, one for moving soil and the other for taking farm products out of the quarantine area without having the articles inspected or certified.

THE ASIATIC BEETLE: QUARANTINE AND INSPECTION

The discovery and spread of the Asiatic beetle, *Anomala orientalis* Waterhouse, has been described in preceding reports of this Station as follows: 1922, page 345, Plate XIV; 1923, page 291, Plate XX; 1924, page 294, Plates XXIV and XXV; 1925, page 309, Plate XI; 1926, page 252, Plates VII-XII; 1927, page 288; 1928, page 743; Bulletin 304; Bulletins of Immediate Information, Numbers 52, 53, 62 and 65. Bulletin 304 is the most complete account of this insect ever published, and the reader is referred to it for information regarding structure, habits and life history. Bulletin of Immediate Information No. 62 is more convenient if one desires information concerning treatment of lawns to prevent injury from the grubs.

A Federal quarantine, No. 66, was established and made effective March 15, 1929, on account of the Asiatic beetle, *Anomala orientalis* Waterhouse, and the Asiatic garden beetle, *Aserica castanea* Arrow. At this time the latter was not known to occur in Connecticut, but the former was known to be present in New Haven and West Haven. After the required legal notice, a public hearing was held at the Station on February 25, 1929, and the following quarantine order was issued. It became effective April 1, 1929:

STATE OF CONNECTICUT

AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

Quarantine Order No. 22

CONCERNING THE ASIATIC BEETLE

The fact has been determined that the Asiatic beetle, *Anomala orientalis* Waterhouse, now occurs in the towns of New Haven and West Haven and it seems advisable to revise the regulations and the restricted areas. A public hearing regarding the matter was held in New Haven, February 25, 1929.

Now, therefore, I, William L. Slate, Director of the Connecticut Agricultural Experiment Station, under authority conferred by Chapter 31, Public Acts of 1927, do hereby proclaim the towns of New Haven and West Haven subject to the restrictive regulations of this quarantine.

Also, the movement of all quarantined articles designated in the regulations

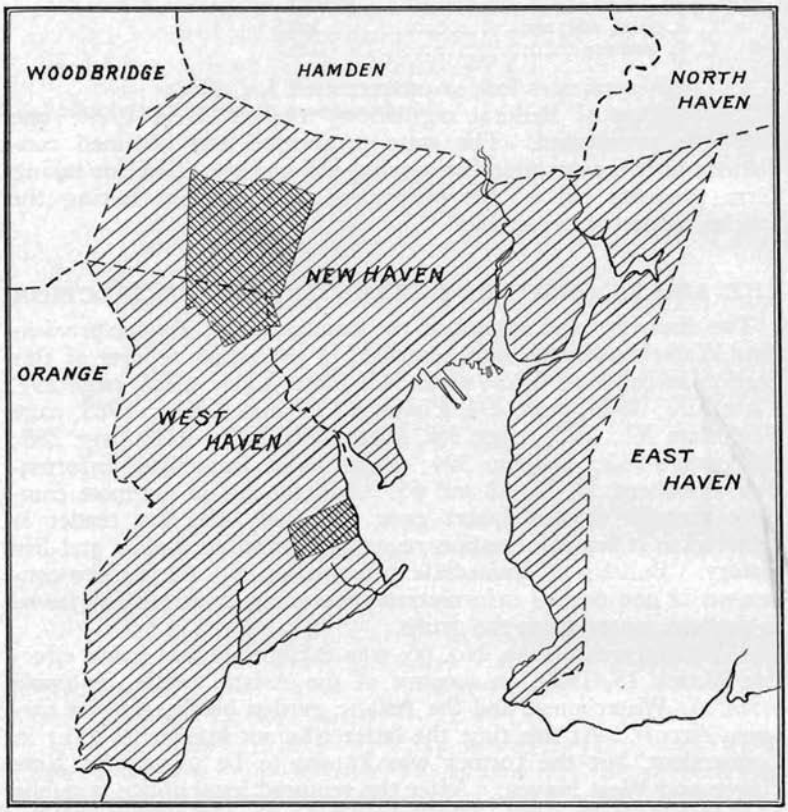

FIGURE 55. Map of New Haven and West Haven now under quarantine on account of Asiatic beetle. Darker shaded sections show infested areas, upon which additional restrictions have been placed by State quarantine.

supplemental hereto are further restricted from any point within the hereinafter designated control areas to other portions of the towns of New Haven and West Haven or to points outside thereof.

The following control areas are hereby designated:

Westville Area:—Bounded by Whalley Avenue, Blake Street, Ruby Street, Moreland Road, Ellsworth Avenue, Derby Avenue, Boulevard, Oak Street, Forest Road, Florence Avenue from a point about 400 feet west of Forest Road, in a straight line northward to West Prospect Street to Whalley

Avenue, and all territory within these boundaries, being partly in New Haven and partly in West Haven.

West Haven Area:—Bounded by Center Street, New Haven Harbor, Brown Street, and Campbell Avenue.

Until further notice the movement of certain articles and materials as designated below will not be permitted except where inspection or treatment is practicable and permits are issued by duly authorized agents of the State or the United States Department of Agriculture.

The articles and materials restricted during the entire year are as follows:

1. Sand, soil, earth, peat, compost and manure;
2. Nursery, ornamental and greenhouse stock, and all other plants;
3. Turf or sod trimmings, lawn or shrub clippings, ground litter, and weeds.

The articles and materials restricted only between June 15 and October 15, inclusive, are as follows:

1. Cut flowers.
2. Hay and straw (freshly cut).

The rules and regulations supplemental to Federal Quarantine No. 66, effective on and after March 15, 1922, or any subsequent amendments thereto, restricting the interstate movement of quarantined articles from the regulated areas, are hereby declared to be in full force and effect with respect to the intrastate movement of quarantined articles from the herein designated areas of Connecticut to portions thereof.

This order shall be effective on and after April 1, 1929.

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

Approved:
JOHN H. TRUMBULL, *Governor.*

It should be noted that the state quarantine, like the Federal quarantine, covers the entire towns of New Haven and West Haven, but the state quarantine places additional restrictions upon the particular areas in those towns that are known to be infested. These areas are shown approximately in Figure 55 and specifically in Figures 56 and 57.

On May 17, 1929, the Asiatic beetle was discovered in a small lawn at 57 Ford Place, Bridgeport. Later, infestations were discovered at 685 Orange Street, and at 45 Glen Road, in New Haven, and at the corner of Main Street and Second Avenue in West Haven, all three being outside the special areas formerly known to be infested, though within the towns of New Haven and West Haven, both of which are under state and Federal quarantine. The Bridgeport infestation is, of course, wholly outside any area quarantined on account of this insect.

During November and December, Mr. B. W. McFarland visited 50 towns and cities in the central and western portion of the state, outside of the area quarantined on account of the Japanese beetle, to ascertain whether any lawns in public parks, golf courses, or on private estates, had been injured during the season

by white grubs. Mr. McFarland made inquiries of town officers, park superintendents, managers of large estates, and superintendents of golf courses. He also drove through the principal streets of these towns and cities and observed the condition of the lawns. Where any such injury had been reported or observed, he visited the localities and examined the soil for grubs. In a few places,

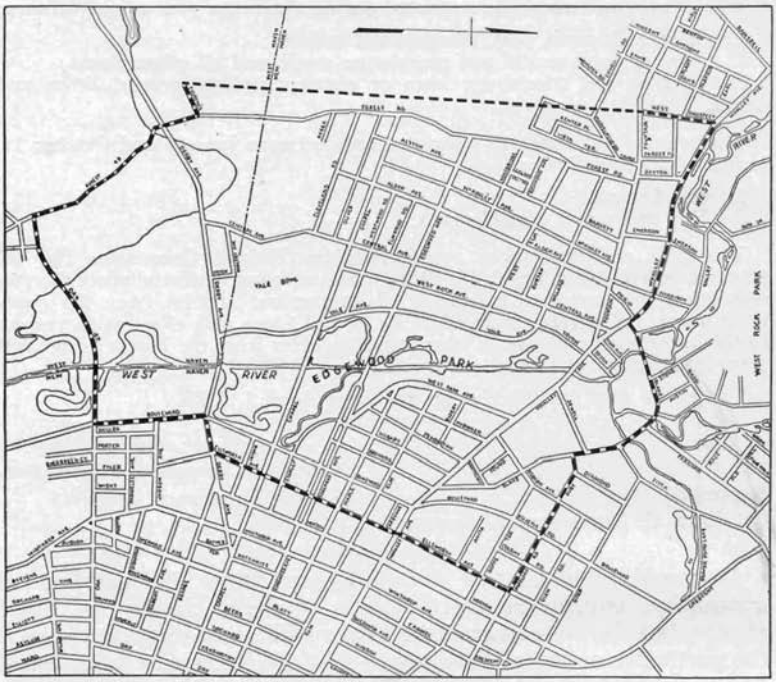

FIGURE 56. Map of the Westville section of New Haven. The area enclosed by dotted line is infested and under special State quarantine restrictions.

the grubs of May or June beetles, *Phyllophaga* sp., were found, but no evidence was secured of the presence of the Asiatic beetle.

The cities and villages visited by Mr. McFarland in this work are as follows:

Bantam	East Berlin	Marble Dale
Berlin	East Morris	Meriden
Bethel	Gaylordsville	Middlebury
Bethlehem	Georgetown	Middletown
Bridgewater	Hawleyville	Milldale
Brookfield	Hotchkissville	Morris
Brookfield Center	Kensington	New Britain
Cheshire	Kent	Newington
Cromwell	Litchfield	New Milford

New Preston	Ridgefield	Wallingford
Newtown	Rocky Hill	Washington
Northville	Roxbury	Watertown
North Woodbury	Sandy Hook	Wethersfield
Oakville	Sherman	Woodbury
Oxford	South Britain	Woodville
Redding	Southbury	Yalesville
Redding Ridge	Southford	

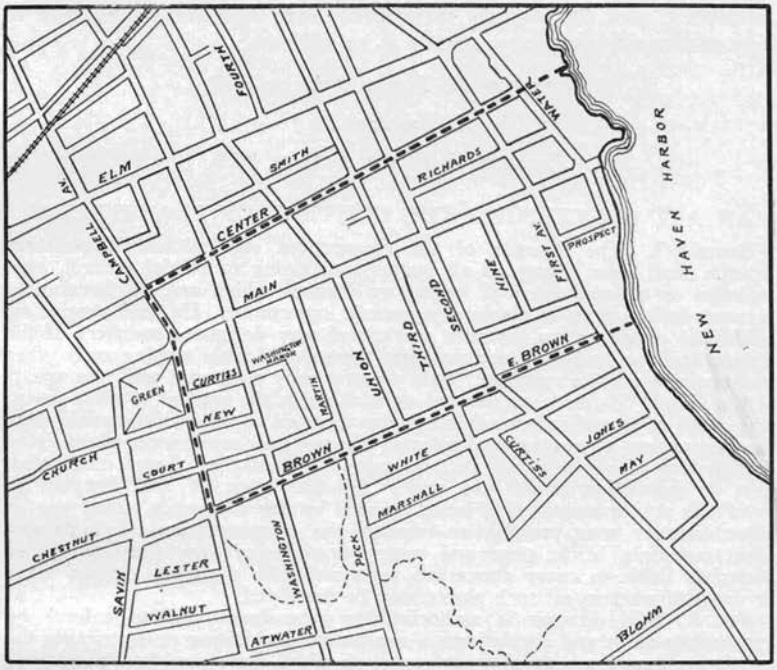

FIGURE 57. Map of section of West Haven. The area enclosed by dotted line is infested and under special State quarantine restrictions.

Mr. McFarland made 34 examinations on request, as follows:

Town	Number of examinations	Asiatic beetles found
New Haven	26	15
West Haven	6	2
Hamden	1	0
Milford	1	0
Total	34	17

Nearly all of these 17 places where Asiatic beetles were found were within the infested area. The first adult was found on June 22, and the last one on August 23. It is our plan to treat all of the outlying infestations with lead arsenate in order to kill the greatest possible number of beetles at the earliest possible date.

THE REVISED INSECT PEST LAW

At the 1927 session of the General Assembly, the insect pest law was revised in order to clarify its provisions and to give increased authority. In making the revision, the penalty clause was somehow omitted. Consequently, the law was again revised by the General Assembly of 1929. Slight changes were made in Section 1, and the penalty provisions were restored as Section 6. The entire act as it now stands is as follows:

CHAPTER 31, PUBLIC ACTS OF 1927

As Amended By

CHAPTER 45, PUBLIC ACTS OF 1929

AN ACT CONCERNING THE CONTROL OF PLANT PESTS

SECTION 1. The director of the Connecticut Agricultural Experiment Station shall have charge of all matters pertaining to official control, suppression or extermination of insects or diseases which are, or threaten to become, serious pests of plants of economic importance. He shall receive no additional compensation for such work, and may designate members of the station staff to carry out certain lines thereof and may employ such other assistance as may be required. Said director may coöperate with the agents of the United States department of agriculture in the control of plant pests; may make rules and orders, subject to the approval of the governor, regarding the destruction or treatment of infested plants; may seize, treat, disinfect or destroy any plants or plant material moved in violation of any quarantine, rule or regulation established under the provisions of said chapter 31 or of this act, or suspected of being infested by any dangerous insect pest or plant disease; may prohibit or regulate the transportation of plants and plant materials, brick, stone and quarry products or any other objects or materials liable to carry dangerous pests and may designate certain areas or districts wherein all such plants may be destroyed.

SEC. 2. Said director is authorized to promulgate, and to enforce by appropriate rules and regulations, a quarantine prohibiting or restricting the transportation of any class of nursery stock, plant, fruit, seed or other article capable of carrying any dangerous plant disease or insect infestation with reference to which the secretary of agriculture of the United States has not determined that a quarantine is necessary and established such quarantine, into or through this state or any portion thereof from any other state, the District of Columbia or any part of such state or said district in which said director shall have found such plant disease or insect infestation to exist.

SEC. 3. Said director is authorized to make rules and regulations for the seizure, inspection, disinfection, destruction, or other disposition of any nursery stock, plant, fruit, seed or other article capable of carrying any dangerous plant disease or insect infestation, a quarantine with respect to which shall have been established by the secretary of agriculture of the United States, and which have been transported to, into or through this state in violation of such quarantine.

SEC. 4. Said director may establish and maintain a quarantine against any premises, district, town or group of towns in this state, provided, before any quarantine shall be established within the state, a public hearing shall be held, of which a five days' notice shall be given to the parties affected, either by mail or by publishing such notice in two newspapers having a circulation in the part of the state affected by such quarantine. Said director, or any person authorized by him to enforce the provisions of this act, may, at any

reasonable time, enter any public or private premises in the performance of his duty.

SEC. 5. Any person aggrieved by any order of quarantine issued under the provisions of this act may appeal to the superior court, or to any judge thereof if said court shall not be in session, and said court or such judge may grant such relief or issue such order or judgment in the premises as to equity may appertain.

SEC. 6. Any person interfering with any person in the performance of his duty under the provisions of said chapter 31 or of this act or violating any quarantine or any other rule or regulation established under said provisions shall be fined not less than five dollars nor more than one hundred dollars.

SEC. 7. This act shall take effect from its passage.

Approved April 10, 1929.

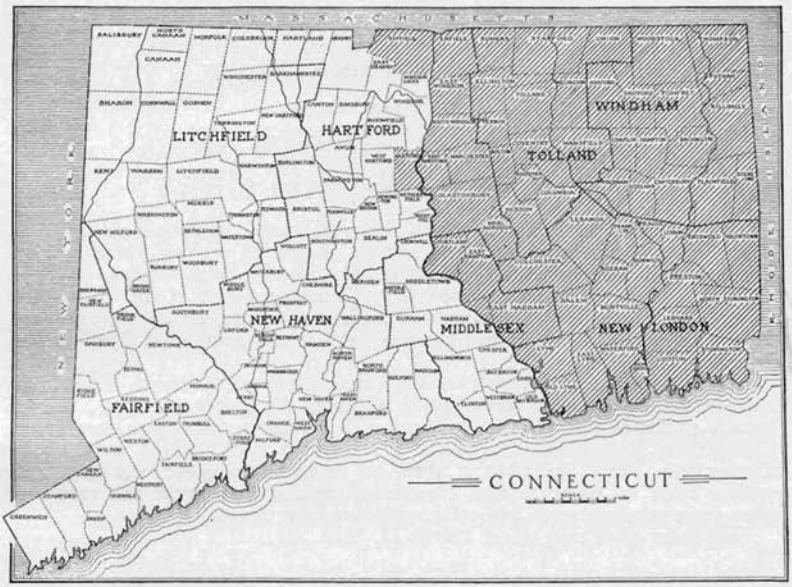

FIGURE 58. Map of Connecticut. Shaded portion is now under State and Federal quarantine on account of the satin moth.

SPREAD OF THE SATIN MOTH

In the report of this Station for 1926, page 264, is a brief account of the satin moth, *Stilpnotia salicis* Linn., and its occurrence in Connecticut. At that time it had been discovered in the towns of Stonington and Thompson, which had been placed under Federal quarantine. Illustrations showing the caterpillars and winter cases of the satin moth may be found on Plate XXI.

This insect feeds chiefly upon willows, but also attacks poplars, sometimes defoliating them. The caterpillars are often seen feeding with gipsy caterpillars and the writer observed such conditions in southeastern New Hampshire last June.

During the winter of 1928-29, state men examined trees in different parts of the state while scouting for gipsy moth eggs, and found the pest to be well scattered over the eastern portion of Connecticut. Also the towns of Hartford and Suffield, west of the Connecticut River, were found infested. Federal Quarantine No. 53 was therefore revised to include these two towns and all territory east of the Connecticut River, effective January 1, 1929. A public hearing regarding a state quarantine was held at the Station February 25, 1929, and the following quarantine order issued:

STATE OF CONNECTICUT

AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

Quarantine Order No. 19

CONCERNING THE SATIN MOTH

The fact has been determined that the satin moth, *Stilpnotia salicis* Linn., a pest of poplar and willow trees, is now present in various towns in Connecticut, and that Federal Quarantine No. 53 has been revised, effective, January 1, 1929, to include all towns in Connecticut east of the Connecticut River, and the towns of Hartford and Suffield, west of the Connecticut River. After due notice a public hearing was held at the Station in New Haven, February 25, 1929.

Now, therefore, I, Director of the Connecticut Agricultural Experiment Station under authority conferred by Chapter 31, Public Acts of 1927, do hereby proclaim that a State quarantine is placed on all towns east of the Connecticut River, and the towns of Hartford and Suffield west of the Connecticut River, and that it shall be unlawful to move any poplar or willow trees or parts thereof capable of propagation, from the restricted area designated above to any other portion of the State.

This order shall take effect March 15, 1929.

W. L. SLATE,

Director, Connecticut Agricultural Experiment Station.

Approved:

JOHN H. TRUMBULL, *Governor.*

The quarantined area is shown in Figure 58. Late in 1929, state scouts reported that the satin moth had been observed in the following additional five towns: Burlington, Farmington, New Britain, Newington and West Hartford. These towns have not yet been placed under quarantine. The satin moth quarantine really amounts to an embargo and shipments of willow and poplar out of the quarantined area are prohibited, it being almost impossible to detect the winter cases. Consequently inspection and certification are not attempted.

THE ASIATIC GARDEN BEETLE IN CONNECTICUT

Aserica castanea Arrow

In the summer of 1928, Mr. Harold C. Hallock of the Federal Bureau of Entomology, stationed at Westbury, Long Island, N. Y., visited New Haven and while walking with Dr. R. B. Friend across the Yale College campus, picked up a dead beetle, which he identified as *Aserica castanea* Arrow. Of course the origin of this beetle was unknown.

A Federal quarantine was established, effective March 15, 1929, covering certain portions of New York, Pennsylvania, and Virginia, and the entire State of New Jersey. Connecticut was not affected by this quarantine because no infestation of living insects of this species had then been discovered in Connecticut. Mr. McFarland was detailed to scout for this beetle evenings around lights on the Yale campus and on August 6, he collected two adults. Another found in New Haven, July 17, was sent in. Mr. Johnson's men carried on similar scouting for beetles in Bridgeport, Bristol, Canaan, Cromwell, Fairfield, Hartford, Middletown, Meriden, New Britain, North Manchester, Putnam, Stafford Springs, Stamford, Torrington, Wallingford, Willimantic, and Winsted and found no beetles. One adult was found in a Japanese beetle trap in New London.

During 1929, Japanese beetle scouts made diggings for grubs in various nurseries, and *Aserica castanea* grubs were found in the following towns: Cromwell, 25; Manchester, 10; Mansfield, 1; New Canaan, 2; and Southport, 2.

Both adults and grubs were identified by Mr. R. J. Sim, of the Japanese Beetle Laboratory at Moorestown, New Jersey. Hence, it is certain that this insect now occurs within the state.

In superficial appearance, this beetle resembles the other species of the genus *Serica,* from which it was separated. *Serica sericea* Ill. and *S. parallela* Casey perhaps most closely resemble *Aserica castanea* Arrow, which when discovered injuring lawns on Long Island was first identified as *Serica parallela.* See Plate XXVI, b.

The beetle is about three-eighths of an inch long, cinnamon brown, dull, the wing-covers well-marked with shallow grooves or striae. The beetles fly at night and are attracted to electric lights; they also feed at night and hide in the soil around the bases of the plants or under rubbish, where they pass the daytime.

The grubs live in the soil and feed upon grass roots, much like the grubs of the Japanese beetle and the Asiatic beetle. The beetles feed upon many kinds of plants, including aster, barberry, bean, cherry, chrysanthemum, currant, dahlia, geranium, catalpa and coniferous seedlings.

Control measures are: Spray with lead arsenate, three pounds in 50 gallons water, plus two pounds of flour, to kill the beetles;

lawns should be treated with lead arsenate, using about three pounds per 100 square feet mixed in the upper three inches of soil, to prevent injury from the grubs.

MOSQUITO CONTROL IN CONNECTICUT IN 1929

R. C. Botsford

The General Assembly, at its last meeting, increased the budget for mosquito control from $7,500 per year to $12,500 per year. This became necessary on account of the addition of about 3,000 acres of ditched salt marsh acceptable for maintenance by this Station. Our estimate showed that $15,000 per year was necessary to maintain properly all acceptable areas, but our request for this amount was not granted. It was therefore impossible to clean up all areas this season.

The new appropriation became available on July 1, and at this time a new plan of maintenance was put into practice. This plan was described in Bulletin 305 of this Station, which contained the report of mosquito control work for the season of 1928. The western district crew was supervised by Nicholas Matiuck; the central district by C. F. Johnson; and the eastern district by Albert Lindquist. Auto transportation was provided for each crew on a mileage basis. Areas under state maintenance were inspected by the Deputy in Charge, and all new ditching was laid out under his direct supervision.

All salt marsh areas that had been newly ditched or completely overhauled within the past five years were patrolled, and all necessary cleaning and spur ditching was done to prevent mosquito development. There remain some areas in Branford, Guilford, and Madison where reditching is necessary. This is being done as rapidly as funds will allow.

Twenty-seven towns in Connecticut contain salt marsh areas; 10 are completely ditched, nine partly ditched, and in eight no ditching has been done.

Work done under contract by Mr. John F. Ross consisted of ditching on Great Island, Old Lyme, in the spring. This utilized a $5,000 appropriation made by the town in 1928.

The town of Old Lyme appropriated another $5,000 in 1929. Work stopped December 24 after cutting 68,366 feet, making the total footage in Old Lyme 214,581 feet. The town of Hamden appropriated $2,500 and 68,357 feet of ditches were cut before freezing weather stopped the work. The large salt marsh at East River in Madison, which has been in bad condition for some time, was completely recut on contract, 148,506 feet of 10 x 24 ditches being remade.

In reviewing the activities of the past five years, we find 11 towns have expended a total of $50,000, representing a total of

2,000,000 feet of new ditching. In the towns of Stamford, East Haven, Branford, and Norwalk, the work was an expansion of ditched area. Westport, Hamden, Westbrook, Saybrook, Old Lyme and East Lyme were new in mosquito elimination work.

For data concerning all towns, the reader is referred to the following tabulation:

STATUS OF CONNECTICUT SALT MARSH AREAS, 1929

Town	Salt marsh areas	Salt marsh ditched	Maintained by State	Total cost of ditching	Labor, cost maintenance, 1929	Labor, cost to complete ditching
Greenwich	200	200	none	$22,000.00	.....	.....
Stamford	300	300	300	3,245.80	$231.20	.....
Darien	300	300	none	3,800.00	.....	.....
Norwalk	600	600	600	7,500.00	427.86	.....
Westport	400	400	400	5,913.82	340.30	.....
Fairfield	1,200	1,200	1,200	8,400.00	842.46	.....
Bridgeport	173	....	....	.....	.....	$ 3,000.00
Stratford	1,315	....	....	.....	.....	20,000.00
Milford	630	....	....	.....	.....	9,500.00
West Haven	463	222	222	.....*	891.46	3,500.00
New Haven	750	750	675	12,000.00	264.53	750.00
Hamden	571	250	250	4,210.17	.....	1,000.00
North Haven	310	....	....	.....	.....	3,100.00
East Haven	545	300	300	3,747.52	119.92	1,300.00
Branford	895	895	895	20,000.00	304.21	.....
Guilford	1,085	1,085	1,085		1,208.78	.....
Madison	1,315	1,315	1,315		5,233.97	.....
Clinton	785	677	500	10,000.00	215.60	2,000.00
Westbrook	500	500	500	7,428.14	136.30	.....
Old Saybrook	1,373	186	186	2,000.00	448.00	13,000.00
Lyme	493	....	....	.....	.....	7,500.00
Old Lyme	1,393	300	300	5,364.52	296.25	7,700.00
East Lyme	424	130	130	1,480.60	176.60	4,000.00
Waterford	204	....	....	.....	.....	3,500.00
New London	34	....	....	.....	.....	500.00
Groton	304	50	50	1,000.00	10.35	4,000.00
Stonington	555	....	....	.....	.....	8,500.00
Totals	17,117	9,660	8,908	$118,098.57	$11,147.79	$92,850.00

Mosquito Control in New Canaan

In New Canaan, an inland town, effective anti-mosquito operations were carried out this year. This movement started on September 27, 1922, when a Red Cross Mosquito Committee was formed, composed of Prof. W. H. Burr, and Messrs. W. E. Swift, G. A. Suter and W. T. Cox, secretary. A preliminary report on mosquito breeding conditions around New Canaan was made by Mr. Walden of this Station in May, 1923, at the request of this committee. From time to time inspections were made and reports submitted concerning mosquito breeding conditions within a radius of one and one-half miles of New Canaan center.

* Ditched with New Haven.

In 1927, a local committee, composed of Messrs. Merrill F. Clarke, Wilmot T. Cox, George A. Suter and Archibald E. Stevenson requested and received an appropriation of $1,000 from the town of New Canaan and the best of coöperation from the town officers, especially Mr. George T. Smith, First Selectman.

This fund was used for oiling the worst breeding places within the central area. The results were so gratifying that a larger sum was appropriated late in 1928, to be expended the following season. In 1929, the committee requested the Station to appoint an expert on mosquito control, who would also be a special deputy with some authority, to supervise the treatment work, study all local mosquito breeding conditions, collect and identify mosquitoes, and submit a complete report. In other words, the committee wished to set an example which might be followed with profit by other towns having similar problems. New Canaan was to be considered an outdoor laboratory for the study of the local mosquito problem and this deputy was expected to inaugurate tests and trials, and make recommendations looking toward its solution. To this special position the Station appointed Mr. Raymond F. Hart, who had served for two summers as a mosquito inspector of the Health Department of the City of New Haven. The report of Mr. Hart follows.

To Dr. W. E. Britton, State and Station Entomologist of the Connecticut Agricultural Station; and to Mr. George T. Smith, First Selectman of the Town of New Canaan.

GENTLEMEN:

I submit, herewith, my report of the season's work in mosquito control in New Canaan, conducted under the supervision of the Connecticut Agricultural Experiment Station. This work covered a period from April 13 to September 14.

The number of mosquito breeding places found totals 70. The most important place, because of the heavy breeding there, was the filter beds. Mosquito larvae in extraordinary numbers were found there several times during the summer, and each time the beds were oiled before the larvae could hatch into mosquitoes. In May, a few pupae were found in two of the beds; but these beds were dry in a few days. In June, another bed was found breeding slightly, and this was treated. Then in July, there was heavy breeding in all the beds on two occasions, necessitating oiling. Once again in August and once in September, there was heavy breeding in all the beds, and they were oiled. Once in the latter part of July and again in the early part of August, there was slight breeding in one bed, and oil was applied. In two concrete holes near the chlorination house, heavy breeding was discovered once in June and twice in July, and these were treated similarly. A water

pipe near the beds was also oiled in July. The proper way of preventing mosquitoes from breeding in the filter beds would be to run them on a definite schedule, so that each bed would be systematically drained every eight or ten days. Allowing three or four days for each bed to dry out, the bed would have water in it for only five or six days, and this period would not be of sufficient duration to allow the mosquitoes to hatch, the time necessary for a mosquito to pass from the egg to the adult stage being from seven to ten days. Since the limited capacity of the filter beds did not permit this procedure, oiling became necessary.

The place next in importance in breeding was along the edges of the Five Mile River, below the point where it receives the effluent from the filter beds. Very heavy breeding was found in the middle of June, and breeding to a lesser extent in July, August, and September, once each month; each time the edges of the river were oiled.

A description of the 68 remaining breeding places is as follows: Thirty were ponds and pools, of which 19 were oiled, two were treated with a larvacide, and nine did not require oiling, because they had but few larvae and were in isolated localities; 14 were swamps and marshes, of which eight were oiled, and six did not require oiling; 10 were streams and brooks, of which seven were oiled, two dried up, and one was in an isolated spot; three were the hoofprints made by cattle, and were oiled; two were catch basins in the roadside and were oiled; two were ditches in the road, which were oiled, and later were found dry; one was a hole among the rocks on the edge of a pond; this was oiled; one was an isolated hole in the woods with only a few larvae; one consisted of two wooden tanks, one in the stables of a barn, the other in the ground behind the barn; they were both oiled; one was a tub for catching the overflow water from a well; the water was emptied from the tub; one was a hole in the ground next to a tennis court; this dried up; one was a well with one or two larvae dipped up in the bucket; one consisted of the notches in a wooden beam of a broken-down mill.

Of the 70 breeding places, 26 were Anopheles—malarial—breeding places, evenly distributed about the town. Of these 26 there was heavy breeding in only eight. These eight places were as follows:

The bird sanctuary duck pond. Several Anopheles larvae were found in May, but the hole dried up; heavy Anopheles breeding was found in July, and the pond was oiled; the pond dried up the latter part of July, and remained dry until September.

Swampy land off Ponus Ridge. Several Anopheles larvae were found in hoofprints in June; these were oiled, and drainage ditches dug. In August many Anopheles larvae were found in the stream running through; this also was oiled.

Dickerman pond off River Street. Several Anopheles larvae were found on three occasions in June, July, and August—once each month—and the edges of the pond were oiled.

The smaller Rae pond on Stamford Road. Anopheles larvae were found in July on two occasions, and the edges of the pond oiled; in the latter part of August, the pond dried up, and remained dry until September.

Pinkham pond on Ponus Ridge. Anopheles larvae were found in July and August, and the edges of the pond were dusted with a mosquito larvacide.

A small pool on Jelliff Mill Road, opposite Jelliff's Mill. Many Anopheles larvae were found the last week in July, and the pool was oiled; thereafter, there was no breeding.

A ditch on the Renner property off Marvin Ridge Road. Many Anopheles larvae were found early in August, and the ditch was oiled; thereafter, there was no breeding.

The smaller pond on the Lapham place. Anopheles larvae were found during the middle of August, and the pond was oiled; afterwards it dried up.

Of the remaining 18:

Nine were ponds, of which five were oiled, and four did not require oiling.

Seven were streams, of which five were oiled, one dried up, and one did not require oiling.

Two were small swampy areas, of which one was oiled, and the other did not require oiling.

All but a few of the back yards within a one-mile radius were inspected for breeding. There were 36 back yard breeding places found, 31 of which were within a one-mile radius. All of the breeding places found were eliminated. There are approximately 31 blocks within the one-mile radius, making an average of one breeding place per block. On one side of Summer Street in the same block, there were five different yards with receptacles breeding mosquitoes; on one side of Harrison Street, there were four such yards.

Night catches for the purpose of catching and identifying mosquitoes were made at 17 different places. These night catches were of 15 minutes duration. At eight places, no mosquitoes were caught; at eight, one mosquito was caught; and at the other, eight mosquitoes were caught. Of the 18 mosquitoes caught, seven were *Anopheles punctipennis,* one was *Anopheles quadrimaculatus,* five were *Mansonia perturbans,* the irritating mosquito, one was *Aedes sylvestris,* the swamp mosquito, one was *Culex pipiens,* the house mosquito, and three were imperfect specimens, which could not be identified. *Anopheles punctipennis* were caught at five out of nine places.

Of 30 mosquitoes caught in the day time, 13 were *Culex pipiens,* six were *Orthopodomyia signifer,* the white-lined mosquito, four were *Aedes canadensis,* the woodland pool mosquito, four were *Aedes triseriatus,* the tree-hole mosquito, one was *Aedes sylvestris,* and two were imperfect specimens, which could not be identified.

Of 96 mosquitoes hatched, 57 were *Culex pipiens,* 21 were *Anopheles punctipennis,* 17 *Aedes canadensis,* and one *Aedes sylvestris.*

The results show *Culex pipiens* as the predominating mosquito, with *Anopheles punctipennis* second, and *Aedes canadensis* a close third. *Orthopodomyia signifer* is a fairly rare species in Connecticut; *Aedes triseriatus* is also rare.

Most of the *Anopheles* mosquitoes found were *punctipennis.* One *quadrimaculatus* was taken in a night catch. *Anopheles punctipennis* was the most abundant mosquito in the town next to *Culex pipiens,* as might be expected from the high number of Anopheles breeding places, 26 out of a total of 70.

Towards the latter part of the season, experiments were made with *Fundulus heteroclitus,* the common killifish, which is effective in salt-marsh mosquito control work, to see if it could be used in an inland town. Many of these fish were put into 11 ponds about the town.

Experiments were also made with *Rhinichthys astronasus,* the black-nosed dace, a fish prevalent in New Canaan waters. The purpose was to ascertain whether it would eat mosquito larvae. Larvae put into a barrel with the dace disappeared by the next day. The same results followed with larvae put into a jar with dace. Larvae also disappeared from a barrel that was breeding mosquitoes, after 25 or 30 fresh dace had been put in.

Larvae were also put into a pond with dace, and five days later Anopheles larvae were found in addition, an Anopheles mosquito having laid her eggs in the interval. Leaves found around the edges of the pond, which might shelter the larvae from the fish, rendered this experiment inconclusive.

On the whole, this season's experiments have not disclosed sufficient facts to draw definite conclusions about the usefulness of these fish in the work.

In closing, I wish to express my thanks to the members of the Experiment Station Staff, to the selectmen and other town officials, and to the members of the voluntary committee for their kindly aid and helpful suggestions; and to the people of New Canaan for their splendid spirit and willing coöperation.

Respectfully submitted,

RAYMOND F. HART,
Special State Deputy in Charge.

September 14, 1929

MISCELLANEOUS INSECT NOTES

European Pine Shoot Moth in Hamden: On May 21, Mr. Zappe collected some larvae of the European pine shoot moth, *Rhyacionia buoliana* Schiff., in shoots of the red pine near Lake Whitney. Adult moths emerged on June 14. See Plate XXV. [W. E. Britton]

Leaf Rollers on Rose: On May 27, some leaf rollers were collected from rose in the writer's garden and placed in breeding cages in the Station insectary. Adults emerged on June 12-15, and three species of moths were obtained. These were *Archips rosana* Linn., *Tortrix albicomana* Clem., and *Epiblema suffusana* Zell. See Plate XX. [W. E. Britton]

Strawberry Whitefly: During September, Doctor Garman brought to the office some strawberry leaves from a field in Branford where on several acres considerable injury had been caused by a whitefly. An examination of the leaves showed it to be the strawberry whitefly, *Trialeurodes packardi* (Morrill). The nymphs were all over the under sides of the leaves. It is a question what remedial measures in a large field will prove effective. The leaves are so close to the ground that spraying is impracticable. Possibly a strong nicotine dust or a cyanide dust could be used, but we have not given either a trial. [W. E. Britton]

Lyctus Beetles: On May 21, the writer had occasion to examine an ice-box in a private residence in New Haven from which adults of *Lyctus opaculus* LeConte were emerging in considerable numbers. This occurrence of these beetles was remarkable in that the ice-box had been in the possession of the family for eight years and no insects had been previously noticed. The wood, ash, was well varnished and there were no exit holes other than those being made at the time of the examination. The probability of the infestation having occurred since the ice-box was made is extremely remote. The adults oviposit in pores in wood, and a coat of varnish acts as a deterrent. [R. B. Friend]

Injury to Young Coniferous Trees by White Grubs: During the season of 1929, the young conifers in the nursery of the State Forester at Simsbury were severely injured by white grubs, *Phyllophaga* sp. The beds of Norway spruce were particularly affected, one-fourth to one-third of the trees in one bed being killed. These trees were two years old and had been transplanted once. When the nursery was examined November 5, the brown areas of dead plants were quite conspicuous. The grubs had eaten off all the small roots and the tips of the larger roots from these plants that were killed. At the time the examination was made, no grubs were present around the roots of the plants, but were found at a depth of about two feet in the soil. [R. B. Friend]

Kermes on Black Oak: In response to a request from the park department of the City of New Haven, several black oaks in East Rock Park were examined on August 12. Small branches on several of these trees were injured by a species of *Kermes,* possibly *Kermes galliformis* Riley. The females occurred in groups around the branches, see Plate XXIII, b, killing the plant tissue and causing it to become darkly colored and shrunken. This scale bears a superficial resemblance to a gall and has been frequently mistaken for such. With two exceptions all the species of *Kermes* occur on oaks and are commonly known as oak gall scales. It is the female sex which causes the injury to the trees; little is known about the biology of the males. [R. B. Friend]

Aphids on Ferns: In February, 1929, attention was called to a heavy infestation of aphids on Boston ferns in the Station greenhouse. These aphids proved to be the black fern aphid, *Idiopterus nephrelepidis* Davis. They feed almost entirely on the under surface of the older fronds. The leaflets were not curled and infested plants showed no direct evidence of injury. The species is a native of the tropics, and in this case was found on ferns recently purchased from a local dealer. See Plate XIX, b.

Sprays of nicotine sulfate with soap and pyrethrum soap at the usual dilution easily controlled this aphid. In spraying, care must be taken to cover the under side of the fronds, where the aphids feed. This can be accomplished by turning the pots on the side, or by use of a spray rod, which directs the spray material against the under side of the fronds. [Neely Turner]

Rose Midge in Greenhouse: In the report of this Station for 1922, page 372, is a note concerning the rose midge, *Dasyneura rhodophaga* Coq., which had injured rose plants in greenhouses in Greenwich. On November 26, 1929, Dr. Friend and Mr. Zappe visited a large rose-growing establishment in Guilford, where considerable injury had been caused by this insect on certain varieties in certain sections of the house. The maggots work in the buds, particularly the flower buds and deform the developing flowers, and the result is often a distortion and blackening of the tender shoots. The maggots enter the soil and pupate and the tiny flies or midges emerge later. It is not a destructive pest of roses out-of-doors. One of the best control measures is to cover the surface of the soil with a layer of ground tobacco, one-fourth inch in depth and to fumigate the house each night for a time, by burning tobacco stems or with one of the commercial nicotine preparations. [W. E. Britton]

Stalk Borer Infesting a Corn Field: On June 19, a report was received from the New Haven County Farm Bureau, that a farmer in East Wallingford was having trouble with borers in his corn

that might prove to be European corn borers. Upon examining the field of about two acres, it was found that the insect was the common stalk borer, *Papaipema nitela* Guen.

The previous owner had a vineyard on this land, which had not been cultivated the past season. There were probably many large-stemmed weeds that had been infested with stalk borers. The present owner pulled out the grapevines in the fall and planted corn in the spring.

The corn was from four to six inches tall and the leaves were turning yellow with many of the tips curled and drying up as shown on Plate XXVII. A count of the plants in short sections of rows in different parts of the field showed from about 15 per cent to more than 50 per cent of the plants infested. The average infestation was estimated to be between 25 and 30 per cent. It was recommended that the owner pull out and burn the infested plants and replant the field. [B. H. Walden]

Injury to Golf Greens by Crambus Larvae: The grass on several of the golf greens of the Wampanoag Country Club at West Hartford was more or less severely injured by the larvae of a species of *Crambus* in the middle of the summer. When the greens were examined August 6, adults of *Crambus leachellus* Zincken were abundant, and it is assumed that this species was responsible for the damage. The injury consisted of small dead winding "lanes" each of which was caused by a single larva. The greens were in the process of being treated with lead arsenate as recommended for the control of the Japanese beetle, and those which had been treated showed little or no injury.

The injury by species of *Crambus* to sod land may be distinguished from that due to other insects by the presence of a web, which the larva spins as it works its way through the sod on or just below the surface. This injury usually passes unnoticed unless very severe. Fertilization of the land will minimize injury by promoting a vigorous growth of the grass, and the lead arsenate treatment as mentioned above should be effective. The biology and control measures of a closely related species, *Crambus trisectus* Walker, have been published by G. G. Ainslie in the United States Department of Agriculture Technical Bulletin 31, November, 1927. [R. B. Friend]

Grass Injured by White Grubs: On September 11, Mr. Johnson investigated a case of white grub injury at Stafford Springs, Conn. In an area of nearly 100 acres, about half of which was residential, and the rest containing a baseball diamond, a portion estimated at 20 acres had the roots eaten off so that the grass was dead and brown. The turf could be rolled up like a carpet as shown on Plate XVI. Ten specimens of grubs brought to the Station were identified by Doctor Friend as larvae of June beetles.

Nine of them were *Phyllophaga fusca* Fröl., and the other was of the same genus though it is doubtful whether or not it is the same species. On September 19, Dr. Friend and Mr. Johnson visited two residences in the Buckingham section of Glastonbury. At one place white grubs had killed the grass on the front lawn and at the other, grass in the backyard had been killed. These grubs were all June beetle larvae, *Phyllophaga* sp. *Phyllophaga* larvae were also received from Salisbury, August 16. In most infestations of this kind, the greatest injury is caused by the nearly mature grubs, which soon transform and emerge as beetles. Three years are required for the complete life cycle, and though some beetles appear and some eggs are laid each season, they may have periods of great abundance and destructiveness, three years apart. It is generally best to cultivate infested fields, and to plow and reseed grass fields and remake lawns where injury occurs.

[W. E. Britton]

The Pit-making Oak Scale: The pit-making oak scale, *Asterolecanium variolosum* Ratz., is locally abundant on chestnut oak, *Quercus prinus,* in Connecticut and frequently injures young trees severely. This insect is indigenous to Europe, where it is found on the British Isles and the Continent, but from its native home it has spread to many parts of the world, being reported from South Africa, New Zealand, New South Wales, Argentina, United States and Canada. Except for its occurrence on olive, reported in California by Essig, it confines itself to oaks. In Connecticut, this scale has been found on scarlet oak, chestnut oak, white oak, and English oak. In the woodland areas near New Haven, it is a serious enemy of young chestnut oak reproduction, often killing small branches or even the entire plant. On white oak it occurs frequently, but not usually in injurious numbers. On the imported English oak, an ornamental tree, it may be a serious pest. See Plate XXIII, a.

Certain natural agencies exercise more or less control over this insect. In America and Europe it is parasitized by the encyrtid *Habrolepis dalmanni* Wwd., and an attempt has been made to establish this parasite in New Zealand. In England, according to Newstead (Monograph of the Coccidae of the British Isles, Vol. I, 1901), it is fed upon extensively by the blue titmouse, *Parus caerulens,* during the winter, and to some extent by the long-tailed titmouse, *Acredula caudata,* during the same season. Artificial control measures should be effective where they are practicable. A dormant spray of lime-sulfur or oil emulsion is recommended.

[R. B. Friend]

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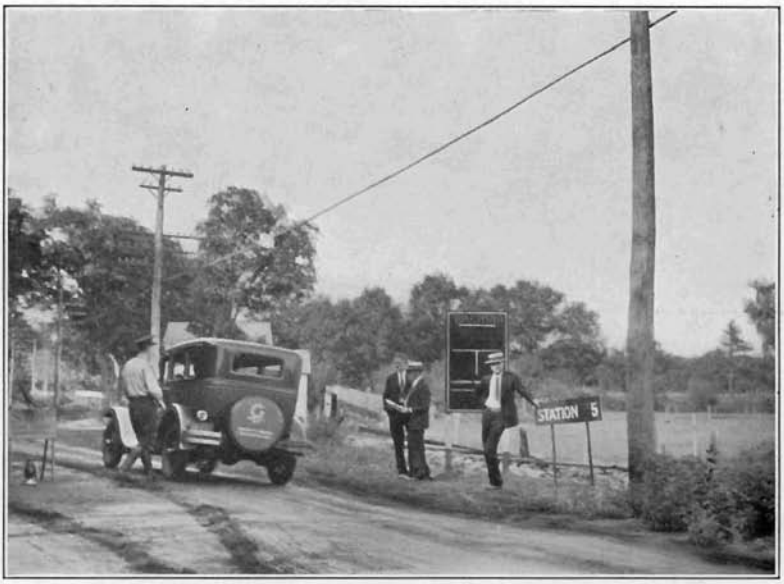
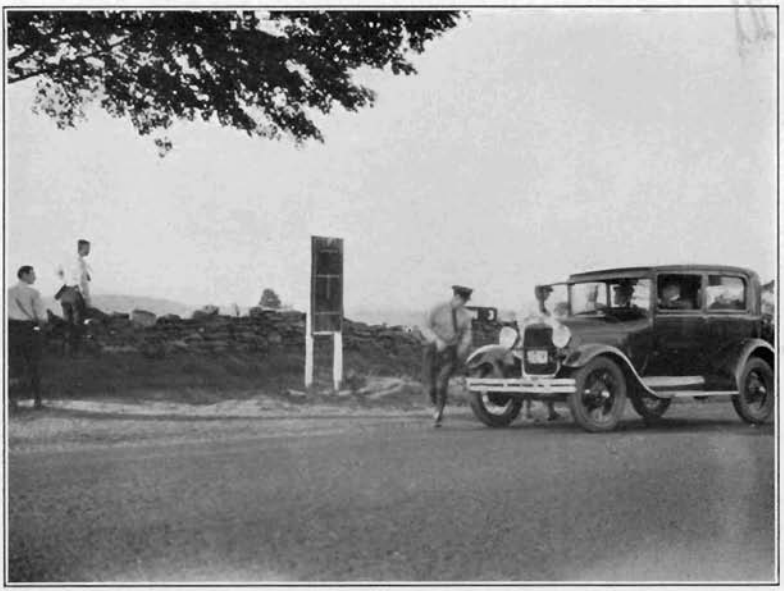
a. Sweet-corn patch in eastern Massachusetts heavily infested with borers. The stalks are so weakened by the feeding of the borers that they soon break over. (After Mass. Dept. of Agric.)

b. European corn borer road patrol station No. 12, Clinton-Madison town line, Post Road.

PLATE XIV



a. European corn borer road patrol station No. 5, Windham-Mansfield town line.

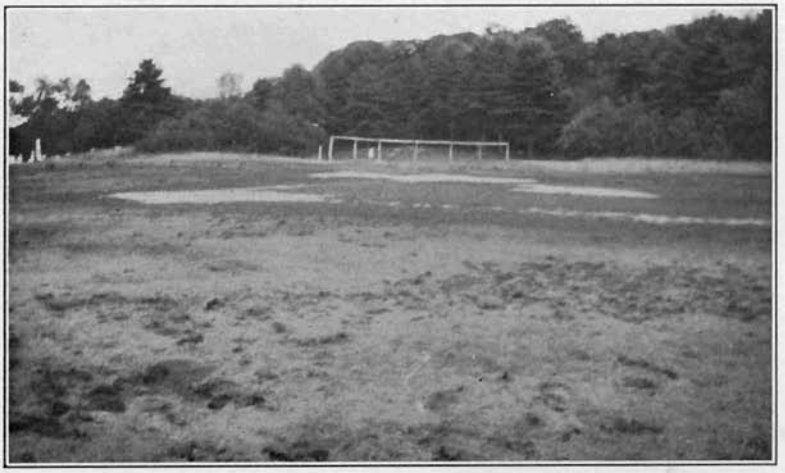


b. European corn borer road patrol station No. 3, Killingly-Brooklyn town line.

a. European corn borer plowing demonstration, Branford.

b. European corn borer plowing demonstration, Branford.

PLATE XVI



a. Lawn injured by white grubs, Stafford Springs.

b. Lawn injured by white grubs, Stafford Springs.

a. Japanese beetle road patrol station, Wallingford-North Haven town line.

b. Japanese beetle road patrol station, Wallingford-North Haven town line; uncertified nursery stock left at station.

PLATE XVIII

a. Japanese beetle treated area on grounds of Hartford Life Insurance Company, Hartford.

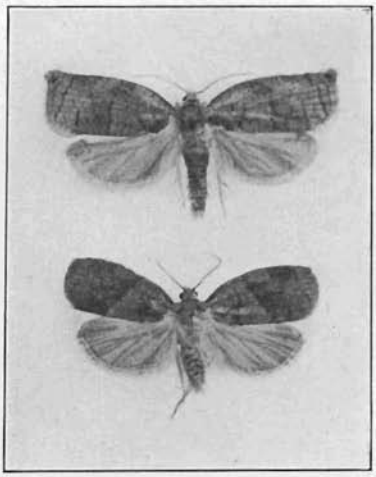
b. Japanese beetle treated area in adjoining yard, Hartford.

a. Unloading Japanese beetle traps, Hartford.

b. Aphids on fern in greenhouse, twice enlarged.

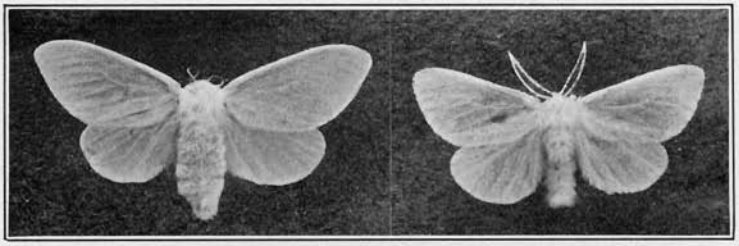
PLATE XX

a. Leaf roller, *Archips rosana*, larvae and pupa, twice enlarged.

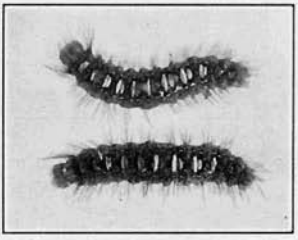


b. Leaf roller, *Archips rosana*, adult moths, twice enlarged.

c. Leaf roller, *Archips rosana*, injury to rose; natural size.



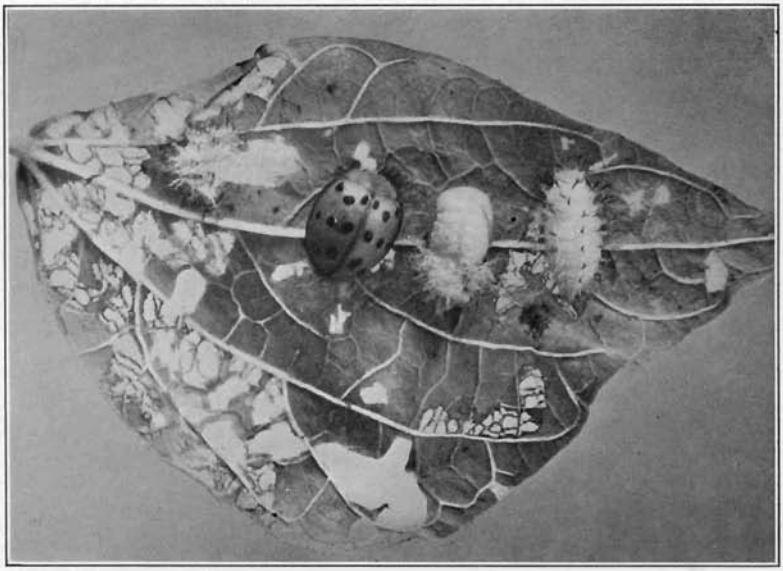
a. Female and male satin moths, natural size. (After Burgess and Crossman, Dept. Bull. 1469, U. S. Dept. of Agric.)



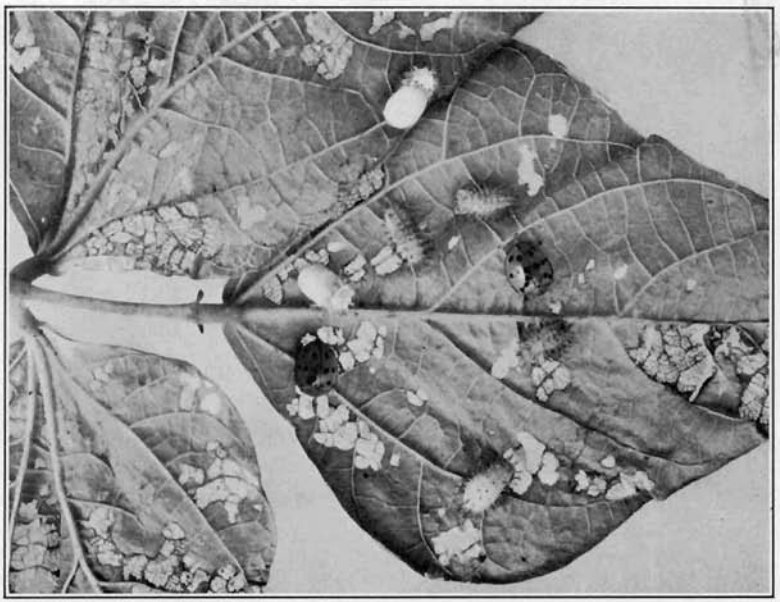
b. Satin moth larvae, natural size.

c. The satin moth. At left, caterpillars, and at right, winter cases. (After Burgess and Crossman, Dept. Bull. 1469, U. S. Dept. of Agric.)

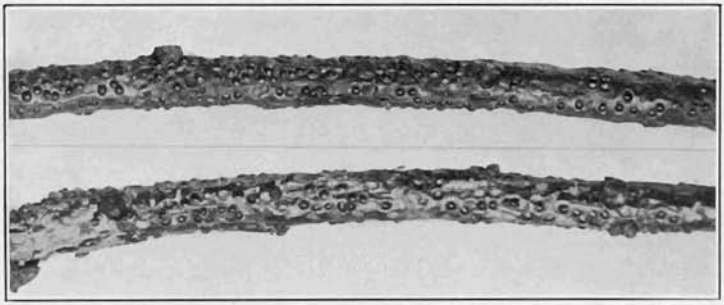
PLATE XXII



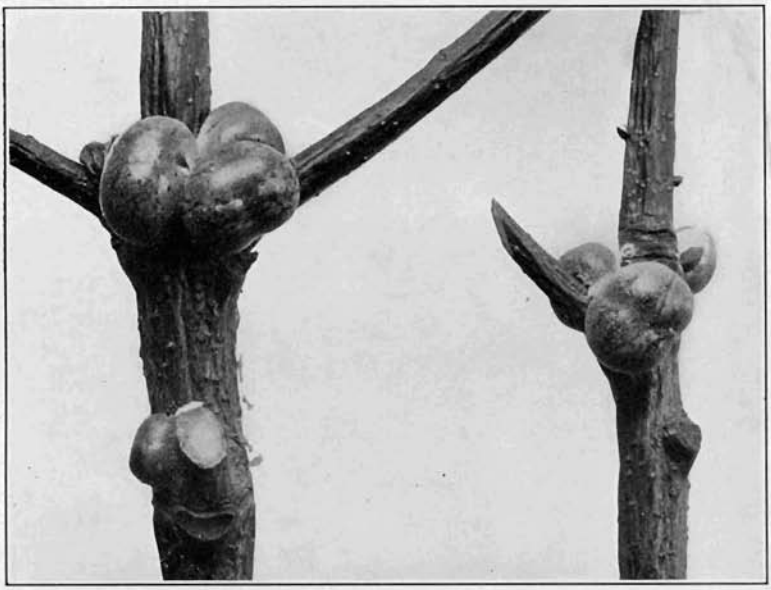
a. Mexican bean beetle, adult, pupa, larva, and injured leaf; twice enlarged.



b. Mexican bean beetle adults, pupa, larvae, and injured leaf; natural size.

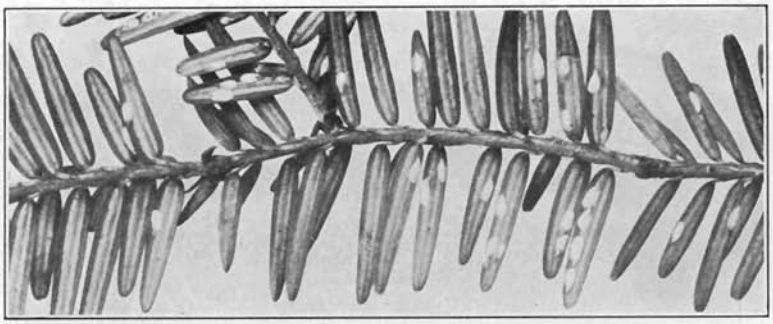


a. Pit-making oak scale, natural size.

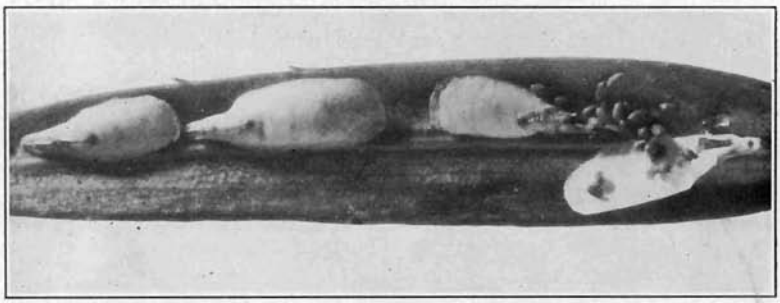


b. Oak gall scale on oak, twice enlarged.

PLATE XXIV

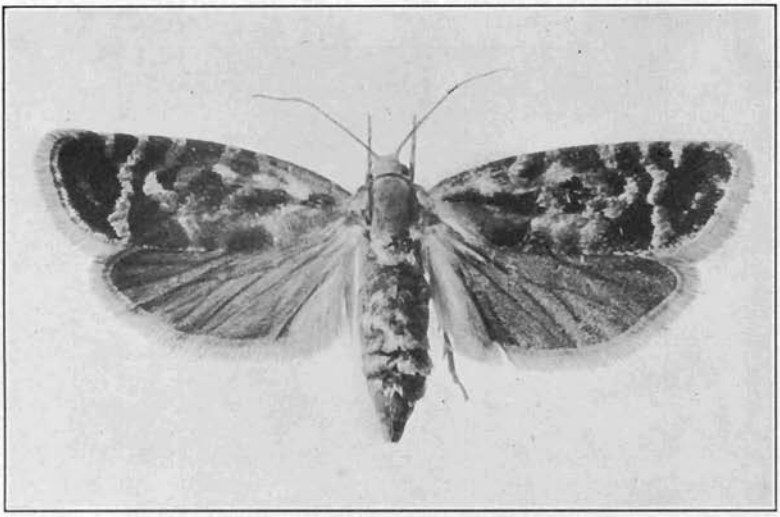


a. Pine leaf scale on hemlock, twice enlarged.

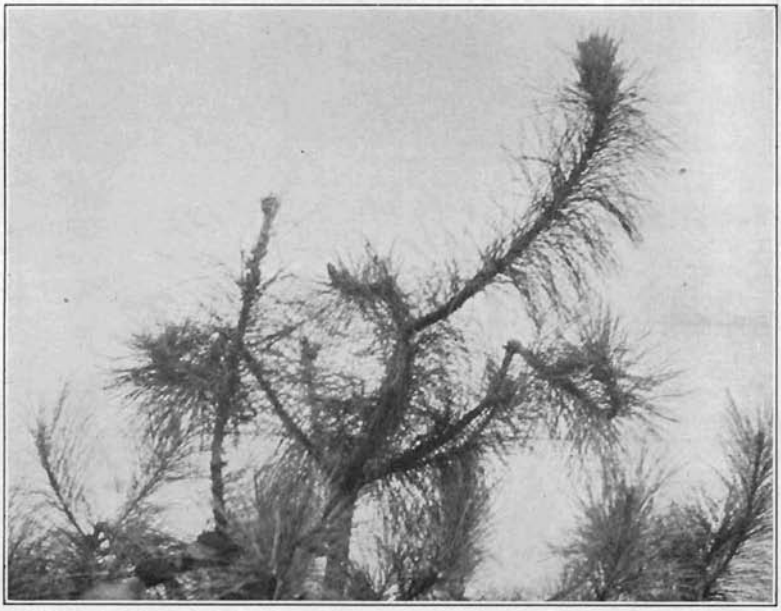


b. Pine leaf scale on hemlock, female shells showing eggs, ten times enlarged.

c. Pine leaf scale on pine, twice enlarged.

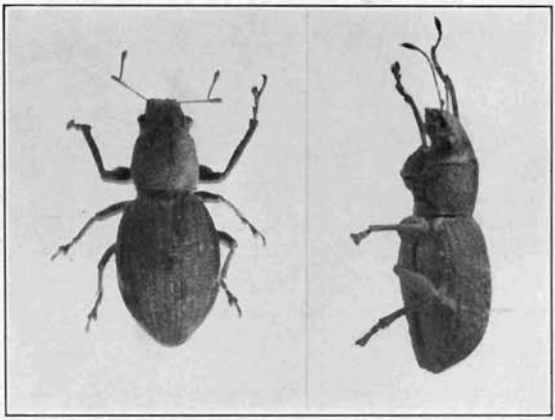


a. European pine shoot moth, adult, four times enlarged.



b. European pine shoot moth injury to red pine.

PLATE XXVI

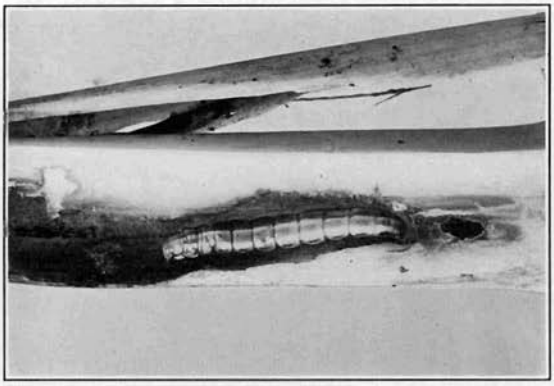


a. Fuller's rose beetle, adults, four times enlarged.

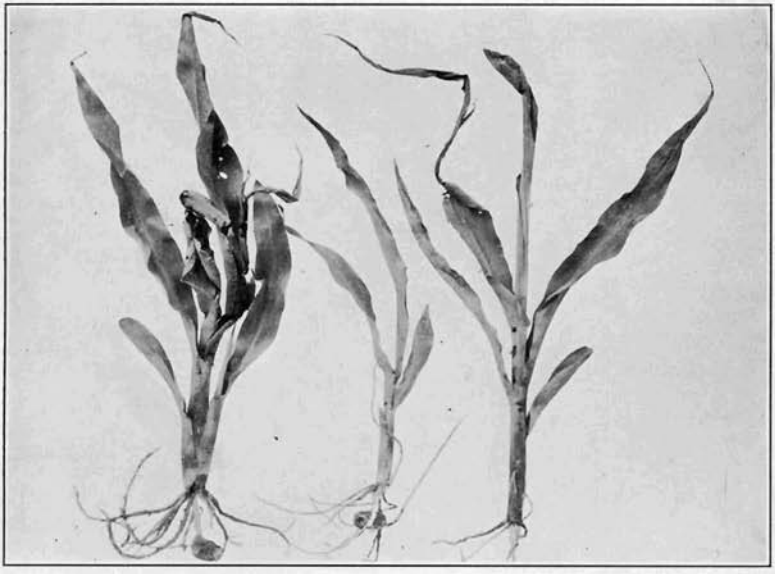
b. Asiatic garden beetle, twice enlarged.

c. Adult of stalk borer, natural size.

d. Immature stalk borer in corn, natural size.



a. Stalk borer larva in corn stalk, natural size.



b. Corn injured by stalk borer.

a. Mosquito breeding area at South End, East Haven, before ditching.

b. Same area after ditching and filling part of the foreground.