Bulletin 408 May, 1938

CONNECTICUT STATE ENTOMOLOGIST

THIRTY-SEVENTH REPORT

1937

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

Connecticut
Agricultural Experiment Station
New Haven

OFFICERS AND STAFF

as of

October 31, 1937

BOARD OF CONTROL

His Excellency, Governor Wilbur L. Cross, *ex-officio, President*

Elijah Rogers, *Vice-President* ..... Southington
Edward C. Schneider, *Secretary* ..... Middletown
William L. Slate, *Treasurer* ..... New Haven
Joseph W. Alsop ..... Avon
Charles G. Morris ..... Newtown
Albert B. Plant ..... Branford
Olcott F. King ..... South Windsor

STAFF

Administration

William L. Slate, B.Sc., *Director*
Louise M. Brautlecht, *Chief Clerk and Librarian*
Katherine M. Palmer, B.Litt., *Editor*
G. E. Graham, *In Charge of Buildings and Grounds*

Analytical Chemistry

E. M. Bailey, Ph.D., *Chemist in Charge*
C. E. Shepard, Owen L. Nolan, Harry J. Fisher, Ph.D., W. T. Mathis, David C. Walden, B.S., *Assistant Chemists*
Rebecca B. Hubbell, Ph.D., *Assistant Biochemist*
Janetha Shepard, *General Assistant*
Chas. W. Soderberg, *Laboratory Assistant*
V. L. Churchill, *Sampling Agent*
Mabel B. Vosburgh, *Secretary*

Biochemistry

H. B. Vickery, Ph.D., *Biochemist in Charge*
George W. Pucher, Ph.D., *Assistant Biochemist*
L. S. Nolan, T. P. Stickney, *General Assistants*

Botany

E. M. Stoddard, B.S., *Acting Botanist in Charge*
Florence A. McCormick, Ph.D., *Pathologist*
A. A. Dunlap, Ph.D., *Assistant Mycologist*
A. D. McDonnell, *General Assistant*

Entomology

W. E. Britton, Ph.D., D.Sc., *Entomologist in Charge, State Entomologist*
B. H. Walden, B.Agr., M. P. Zappe, B.S., Philip Garman, Ph.D., Roger B. Friend, Ph.D., Neely Turner, M.A., *Assistant Entomologists*
John T. Ashworth, *Deputy in Charge of Gypsy Moth Control*
R. C. Botsford, *Deputy in Charge of Mosquito Elimination*
J. P. Johnson, B.S., *Deputy in Charge of Japanese Beetle Control*
Helen A. Hulse, Betty Scoville, *Secretaries*

Forestry

Walter O. Filley, *Forester in Charge*
H. W. Hicock, M.F., *Assistant Forester*
J. E. Riley, Jr., M.F., *In Charge of Blister Rust Control**
Pauline A. Merchant, *Secretary*

Plant Breeding

Donald F. Jones, Sc.D., *Geneticist in Charge*
W. Ralph Singleton, Sc.D., Lawrence Curtis, B.S., *Assistant Geneticists*
Elizabeth Williams, B.S., *Research Assistant*
Mildred H. Preston, *Secretary*

Soils

M. F. Morgan, Ph.D., *Agronomist in Charge*
H. G. M. Jacobson, M.S., Herbert A. Lunt, Ph.D., *Assistant Agronomists*
Dwight B. Downs, *General Assistant*
Geraldine Everett, *Secretary*

Tobacco Substation at Windsor

Paul J. Anderson, Ph.D., *Pathologist in Charge*
T. R. Swanback, M.S., *Agronomist*
O. E. Street, Ph.D., *Plant Physiologist*
C. E. Swanson, *Laboratory Technician*
Dorothy Lenard, *Secretary*

---

* In coöperation with the U. S. D. A.

CONTENTS

	Page
Entomological Features of 1937	137
Insect Record for 1937	138
Fruit Insects	138
Vegetable Insects	139
Shade and Forest Tree Insects	140
Insects of Ornamental Shrubs and Vines	144
Insects of Flowers and Greenhouse Plants	145
Insects Infesting Stored Food Products	146
Household Insects	147
Insects Infesting Timbers and Wood Products	148
Insects of Soil and Lawn	148
Insects Annoying Man and Domestic Animals	149
Spiders	149
Beneficial Insects	149
Miscellaneous	150
Conference of Connecticut Entomologists	153
Inspection of Nurseries, 1937	154
Number and Size of Nurseries	154
Connecticut Nursery Firms Certified in 1937	155
Other Kinds of Certificates Issued	162
Inspection of Imported Nursery Stock	163
Results of Inspection	163
Inspection of Apiaries, 1937	164
Statistics of Inspection	165
Summary	169
Financial Statement	170
Registration of Bees	170
Report on Control of the Gypsy Moth, 1937	171
New Equipment	171
Control Operations	171
Work Performed by State Men	171
Work Performed by CCC Men	172
WPA Work Performed	172
Resettlement Administration Project	173
Scouting for Brown-Tail Moth	173
Statistics of Infestations, 1936-1937	174
Summary of Statistics	178
Financial Statement	179
The European Corn Borer in 1937	180
Enforcement of the Compulsory Clean-up	180
Insecticide Investigations	181
Date of Planting in Relation to Corn Borer Injury	182
Japanese Beetle Work in Connecticut, 1937	185
Scouting	185
Trapping	186
Inspection and Certification	186
General Japanese Beetle Survey	187
Japanese Beetle Parasite Introduction	189
Adult Japanese Beetle Populations	191
The Armyworm in Connecticut	191
The Outbreak in 1937	193
Life History and Habits	194
Description	196
Natural Enemies	197
Control Measures	198
Literature	199

PAGE

TESTS OF APPLE SPRAYS, 1937 ... 200
Number and Time of Applications ... 200
Lead Arsenate-Lime and Fish Oil at Greenwich ... 203
Cedar Rust Control on Wealthy ... 204

DORMANT SPRAYS FOR CONTROL OF PINE LEAF SCALE ... 205
Spring Sprays ... 206

CASE STUDIES IN TERMITE CONTROL ... 208
Complete Shielding of Infested Buildings ... 209
Buildings Partially Shielded or Structural Changes Other Than Shielding ... 212
Infested Buildings Treated by Commercial Termite Control Companies ... 214
Cases Involving Unusual Factors ... 214
Hazards of Termite Treatments ... 216
Literature Cited ... 217

CONTROL OF ONION THRIPS ... 218

EUROPEAN RED MITE CONTROL INVESTIGATIONS, 1937 ... 219

CURCULIO CONTROL ON PEACHES ... 221

ORIENTAL FRUIT MOTH PARASITE WORK, 1937 ... 222

EXPERIMENTS WITH SPRAY CONTROLS FOR THE ORIENTAL FRUIT MOTH ... 227

OBSERVATIONS ON TRICHOGRAMMA IN CONNECTICUT PEACH ORCHARDS, 1935 ... 228

FURTHER STUDIES ON APPLE MAGGOT CONTROL ... 230

RESULTS OF TWO YEARS, FIELD EXPERIMENTS WITH STICKERS FOR DRY LIME SULFUR-LEAD ARSENATE SPRAY MIXTURES ... 232

CHECK LIST OF ELM INSECTS ... 235

CONTROL OF THE SQUASH BUG ... 243

THE PERIODICAL CICADA IN CONNECTICUT IN 1937 ... 248

PRESENT STATUS OF MOSQUITO CONTROL WORK IN CONNECTICUT, 1937 ... 250

MISCELLANEOUS INSECT NOTES ... 252
Prevalence of Potato Leafhopper ... 252
Raspberry Plants Damaged by *Phyllophaga tristis* ... 252
Canker Worms in 1937 ... 253
Damage to a House by the Furniture Beetle ... 253
Records of Ticks in Station Collection ... 254
Plant Bugs on Peaches ... 254
Lawns Damaged by *Ochrosidia villosa* Burm ... 254
Damage by Wireworms ... 255
The Tent Caterpillar in 1937 ... 255
Hornworms on Tobacco ... 255
A New Species of Mealybug in Connecticut ... 255
Peach Borer in Nursery Stock ... 256
Young Chestnut Trees Damaged by June Beetles ... 256
Nacerda melanura Linn., in a Store ... 257
Dahlias Damaged by Spotted Cucumber Beetle ... 257
Plum Petals Devoured by a Scarabaeid Beetle ... 257
Strawberry Plants Damaged by a Leaf Beetle ... 258
Rose Chafer Abundant Locally ... 258
A Wood-Boring Wasp ... 258
Typhaea fumata Linn., a Nuisance in a Dairy ... 258
Damage to Ears of Corn by Corn Root Worm ... 259
Small Brown Beetles a Nuisance in New Canaan Homes ... 260
Infestation of House Crickets ... 260
Melon Worm in Connecticut ... 261
Lawns Damaged by an Andrenid Bee ... 261

FINANCIAL STATEMENT ... 263

PUBLICATIONS, 1937 ... 264

SUMMARY OF OFFICE AND INSPECTION WORK ... 265

ILLUSTRATIONS ... 266

INDEX ... xi

CONNECTICUT STATE ENTOMOLOGIST

THIRTY-SEVENTH REPORT

1937

W. E. Britton

ENTOMOLOGICAL FEATURES OF 1937

The winter of 1936-37 was unusually mild, with little snowfall and no very low temperatures near the coast. Although temperatures were much lower at certain inland points, apparently little or no damage resulted as there was a full peach crop. In general, plants came through the winter without climatic injury.

The year was outstanding because of unusually heavy rainfall. For the first 10 months, the total precipitation at the Mount Carmel farm was 46.74 inches, or 8.41 inches above the normal which is 38.33 inches. Less than the normal amount fell during the months of February, March, May, July and September. A considerable increase above the normal occurred during January, April, June, August and October. Although less than the normal amount of rainfall occurred during the growing months of May, July and September it was well distributed, and the shortage was not sufficient to affect the growing crops. In fact, good crops were obtained.

Some of the more important entomological features of the season were the rather general and severe outbreak of the armyworm, *Cirphis unipuncta* Haw.; occurrence of Brood XI of the periodical cicada, *Magicicada (Tibicen) septendecim* Linn., in Willington; the increased abundance of sawflies, Oriental fruit moth, *Grapholitha molesta* Busck, several species of orchard plant bugs, fleas, onion thrips, *Thrips tabaci* Linde., Mexican bean beetle, *Epilachna varivestis* Muls. (*corrupta*), European corn borer, *Pyrausta nubilalis* Hubn., Japanese beetle, *Popillia japonica* Newm., a native beetle, *Ochrosidia villosa* Burm., and the Chinese mantid, *Tenodera sinensis* Sauss.; the decreased abundance of aphids, fall webworm, *Hyphantria cunea* Dru., tent caterpillar, *Malacosoma americana* Fabr., forest tent caterpillar, *Malacosma disstria* Hubn., canker worms, cabbage maggot, *Hylemyia brassicae* Bouché, and gladiolus thrips, *Taeniothrips simplex* Morr.

Some of the more important entomological features of 1937 are given in greater detail in separate articles and notes printed on other pages in this report. An insect pest survey of Connecticut for 1937 is presented in the following list:

INSECT RECORD FOR 1937

Fruit Insects

Name — Locality, host, date and remarks.

Alsophila pometaria, fall canker worm. Less prevalent than in 1936, but, according to Dr. E. P. Felt, was somewhat numerous around Stamford, and it was locally abundant on apple in Litchfield County.

Anuraphis roseus, rosy apple aphid. Less abundant than usual and scarce in most orchards. Wallingford, Aug. 13.

Aphis pomi, green apple aphid. Much less prevalent than usual.

Aspidiotus perniciosus, San José scale. Present here and there but not in destructive numbers. On apple, small twig heavily infested, West Haven, Dec. 30, 1936.

Autoserica castanea, Asiatic garden beetle. Increasing in abundance. Adults damaged plum trees and grapevines, Darien, Aug. 10.

Cacoecia argyrospila, fruit tree leaf roller. Only a trace seen in apple orchards.

Carpocapsa pomonella, codling moth. Probably somewhat more prevalent than in 1936.

Conopia exitiosa, peach borer. Caused considerable damage to young trees in nurseries. Pupa case, Derby, July 21.

Conotrachelus nenuphar, plum curculio. Abundant in certain apple orchards in New Haven County. Characteristic scars on apples, Norwalk, Dec. 1, 1936; Wallingford, Aug. 13; Shelton, Oct. 7; damaged peach fruit, New Haven, Sept. 9.

Dasyneura pyri, a pear midge. Curling pear leaves, Greenwich, June 19.

Datana ministra, yellow-necked caterpillar. Larvae, Newtown, July 31; Plantsville, Sept. 1; Meriden, Sept. 14.

Empoasca fabae, potato leafhopper. Extremely prevalent on apple foliage, more so than for the past ten years. On apple leaves, Cannondale, June 29; Norfolk, July 1.

Eriophyes pyri, pear leaf blister mite. On pear, Sound View, May 21.

Eulia velutinana, red-banded leaf roller. More prevalent than in 1936, and in one apple orchard about 9 percent of the fruit showed injury at harvest time. Damaged fruit, Shelton, Oct. 7.

Euphoria inda, bumble flower beetle. Adult on pear tree, Woodmont, May 27.

Grapholitha molesta, Oriental fruit moth. More prevalent and destructive than in 1936. In some peach orchards fruit infestation varied from 10 to 50 percent. Larvae crawling about in kitchen, Farmington, Sept. 16.

Hoplia trifasciata, a small Scarabaeid beetle. Adults devoured petals of plum trees, Bethel, May 15.

Laspeyresia prunivora, lesser apple worm. Caused considerable damage in one apple orchard.

Lygidia mendax, apple redbug. Damaged fruit, New Haven, July 16.

Lygus sp. Several kinds of orchard plant bugs damaged peach and apple fruit, particularly next to woodland.

Macrodactylus subspinosus, rose chafer. Adults damaged apple leaves, Guilford, June 15; adults damaged peach fruit, Hartford, June 28, Aug. 16.

Malacosoma americana, tent caterpillar. Abundant locally, but generally less prevalent than in 1936. Cocoons on building, Milford, July 1.

Paratetranychus pilosus, European red mite. Eggs were less abundant than in 1936, and the pest was scarce generally in New Haven County.

Paria canella, a strawberry root worm. Adults damaged strawberry leaves, Bolton and Manchester, May 10; adults damaged filbert leaves at North Stamford.

Pelidnota punctata, spotted grapevine beetle. Adults, New Haven, June 2, July 20; Danielson, July 16.

Fruit Insects—(*Continued*)

Name — Locality, host, date and remarks

Phyllocoptes schlechtendali, a mite on pear. Wooster, Ohio, Aug. 10.

Phyllophaga tristis, a small species of June beetle. Adults damaged raspberry plants, Orange, June 1.

Phylloxera vitifoliae, grape phylloxera. Galls on grape leaf, East Hartford, Sept. 4.

Psyllia pyricola, pear psylla. Present in usual numbers in New Haven County early in the season, but decreased and a clean crop of fruit was harvested.

Rhagoletis pomonella, apple maggot. Flies emerged earlier than usual, were present in moderate numbers in certain orchards and the maggots damaged early fruit in New Haven County. Damaged apples, Norwalk, Dec. 1, 1936; Shelton, Oct. 7.

Schizura concinna, red-humped caterpillar. Larvae on apple leaves, New Milford, July 13.

Scolytus rugulosus, shot-hole borer. Damaged peach twigs, Hartford, Aug. 16; New Haven, Aug. 24.

Scolytus sulcatus, a bark beetle. Adults damaged crab apple branches, Greenwich, June 10.

Sphecodina abbotii, Abbot sphinx. Larvae feeding on grape leaves, New Haven, July 24.

Springtail (unidentified Thysanurid). On apple trees, Somers, Dec. 4, 1936.

Typhlocyba pomaria, white apple leafhopper. Present in some orchards and scarce or absent in others. In orchards of New Haven County, present in average numbers but infestations were irregular.

Vegetable Insects

Anasa tristis, squash bug. Somewhat less prevalent than usual. Adult in building, Greens Farms, Oct. 7.

Ants (unidentified). Attending root aphids on tobacco, Windsor, July 2.

Ascia (*Pontia*) *rapae*, cabbage worm. Larvae appeared early in the season but caused little damage.

Autographa brassicae, cabbage looper. Prevalent generally on cabbage and rather destructive in some plantations.

Autoserica castanea, Asiatic garden beetle. Adults damaged lima beans, Darien, Aug. 10.

Cirphis unipuncta, armyworm. Unusually prevalent, and damaged crops in Berlin, Brooklyn, Farmington, Griswold, Guilford, Hampton, Newington, North Stonington, Southbury, Torrington and Woodstock, in July.

Crioceris asparagi, asparagus beetle. Somewhat less abundant than usual.

Cutworms. Locally prevalent and caused the usual amount of damage.

Deloyala clavata, clavate tortoise beetle. Pupa and adult on Chinese lantern plant, *Physalis alkekengi*, South Meriden, Aug. 2.

Diabrotica longicornis, corn root worm. Adults damaged sweet corn by shredding the husks and feeding on the tender kernels, Lakeville, Sept. 2.

Diabrotica vittata, striped cucumber beetle. Present everywhere in normal numbers.

Diaphania hyalinata, melon worm. Rare in Connecticut. Larvae in summer squash, Ridgefield, Oct. 30.

Empoasca fabae, potato leafhopper. Abundant on potatoes and unsprayed fields showed severe tip burn, July 19.

Epicauta marginata, margined blister beetle. Adults damaged beets and spinach by devouring the leaves, Niantic, July 24.

Vegetable Insects—(*Continued*)

Name — Locality, host, date and remarks.

Epilachna varivestis (*corrupta*), Mexican bean beetle. Caused more damage to beans than for the past three years. Damaged bean leaves, Bridgeport, July 16.

Epitrix cucumeris, potato flea beetle. Abundant in southern Connecticut and locally destructive. Heavy damage to untreated fields. Damaged potato leaf, Naugatuck, June 2.

Heliothis obsoleta, corn ear worm. Larvae appeared earlier in the season than usual, but the pest was perhaps less destructive than in most seasons. About 5 percent of early sweet corn infested in southern Connecticut.

Hylemyia brassicae, cabbage maggot. Distinctly less prevalent than usual.

Hylemyia cilicrura, seed corn maggot. Severely damaged young tobacco plants and necessitated resetting.

Illinoia pisi, pea aphid. Several rather heavy infestations in pea plantations were entirely eliminated by ladybeetles.

Illinoia solanifolii, potato aphid. Less troublesome than in 1935.

Larvae (unidentified), feeding on eggplant, New Haven, July 22.

Leptinotarsa decemlineata, Colorado potato beetle. Fairly common but less troublesome than in some seasons.

Limonius (*Pheletes*) *ectypus*, eastern field wireworm. Caused a 50 percent loss in an oat field formerly in tobacco. In a 5-acre tent field all plants had to be reset. All these were in Hartford County.

Melanotus sp. Wireworms severely damaged half an acre of lettuce, 3 to 4 larvae per plant, Fairfield, May 4.

Melittia satyriniformis, squash borer. Somewhat less prevalent than usual. Larvae damaged squash vines, New Haven, July 29.

Pachystethus lucicola, light-loving grapevine beetle. Adults feeding on bean foliage, Milford, July 7.

Pegomyia hyoscyami, spinach leaf miner. More prevalent than in some seasons, and caused some damage to beets, but not much to spinach. Beet leaves with mines, larvae and pupae, Bolton, June 14.

Plutella maculipennis, diamond-back moth. Present in moderate numbers in most cabbage fields.

Protoparce (*Phlegethontius*) *quinquemaculata*, tobacco worm. Very abundant on tobacco suckers, more so than in 43 years. Adults, East Haven, June 11; Chester, Sept. 7.

Pyrausta nubilalis, European corn borer. Heavy infestations in certain river valleys, and severe damage occurred to early sweet corn by first generation larvae and to late sweet corn by larvae of second generation. Pupa in corn, New Haven, July 28.

Sibine stimulea, saddle-back caterpillar. Larvae on corn, New Haven, Aug. 24.

Thrips tabaci, onion thrips. Exceedingly prevalent and severely damaged set and seed onions at Southington.

Trifidaphis phaseoli, a root aphid. Infested the roots of sun-grown tobacco on a half-acre field, formerly in pasture, at Windsor.

Shade and Forest Tree Insects

Acrobasis juglandis, a walnut case bearer. Damaged black walnut in Brookfield, according to Dr. E. P. Felt.

Adelges abietis, spruce gall aphid. Normally abundant. Characteristic galls from the following 21 localities: Derby, Dec. 28, 1936; Greenwich, Jan. 10; Ansonia,

Shade and Forest Tree Insects—(*Continued*)

Name — Locality, host, date and remarks.

Apr. 20 New Britain, Apr. 26; New Canaan, Apr. 29; Middletown, May 3; Branford, May 12; Cannondale, May 12; Washington, June 17; New Milford, June 18; New Haven, June 24; Waterbury, July 1; Westport, July 1; Riverside, July 21; New London, Aug. 9; Bantam, Sept. 3; Hamden, Sept. 23; Darien, Sept. 29; Stamford, Oct. 5; Danbury, Oct. 16; Woodbury, Oct. 17.

Adelges (*Gillettea*) *cooleyi*, Sitka spruce gall aphid. Moderately common on blue spruce, Windsor, Mar. 25; New Haven, Aug. 3; New London, Aug. 9.

Adelges cooleyi var. *coweni*. On Douglas fir, Old Lyme, June 11.

Alsophila pometaria, fall canker worm. Less prevalent than in 1936, but somewhat abundant locally and damaged elm foliage here and there in Litchfield County; larvae, Groton, June 4; damaged elm leaves, Mystic, July 3.

Andricus punctatus, gouty oak gall. Galls on black oak, West Haven, Mar. 30.

Antispila nyssaefoliella, sour gum leaf miner. Mined leaves, South Meriden, Aug. 3.

Aphids (unidentified). Eggs on Carolina poplar, South Meriden, Jan. 10; honeydew on European white birch, Ansonia, May 18; wingless aphids on oak, Hamden, June 1.

Argyresthia thuiella, arborvitae leaf miner. Locally abundant. Caused considerable damage in Westport, according to Dr. E. P. Felt; mined leaves, Branford, May 12.

Aspidiotus abietis, a leaf scale. Reported by Dr. E. P. Felt as causing considerable damage to a small hemlock in Greenwich.

Aspidiotus tsugae, a leaf scale. Rather severe damage to hemlock, Greenwich, Aug. 4.

Asterolecanium variolosum, pit-making oak scale. On oak, Bridgeport, Aug. 18, Sept. 2.

Bucculatrix sp. (unidentified). Cocoons on oak, New Haven, July 9.

Caulacampus (*Priophorus*) *acericaulis*, maple leaf stem borer. Characteristic damage to sugar maple, Higganum, June 10.

Cecidomyia serotinae, wild cherry bud gall. Hamden, Feb. 6.

Ceratomia amyntor, four-horned sphinx. Adult, New Haven, June 29; Tylerville, July 16.

Chionaspis americana, elm scurfy scale. Elm twigs heavily infested, New Haven, July 15.

Chionaspis pinifoliae, pine leaf scale. On mugho pine, Lyme, Mar. 1; Chester, Sept. 2; on Scotch pine, Milford, Apr. 19 on white pine, Meriden, July 24.

Coleophora laricella, larch case bearer. Foliage of many trees browned in Litchfield County. Hamden, May 21.

Conopia (*Sesia*) *acerni*, maple callus borer. Characteristic swellings with tunnels, New Jersey, July 2.

Corythucha arcuata, oak lacebug. On white oak, New Hartford, Aug. 24.

Corythucha ciliata, sycamore lacebug. On sycamore, Greenwich, Aug. 21.

Corythucha ulmi, elm lacebug. Rather prevalent in Litchfield County and caused elm foliage to turn brown in certain areas. West Cornwall, Aug. 10; Kent, Aug. 21; Bantam, Sept. 3.

Corythucha sp. On Japanese walnut, Guilford, May 27.

Cyllene caryae, hickory borer. Adults in houses, probably emerged from fuel wood, New Haven, Jan. 25, Feb. 12; Pomfret Center, Mar. 30.

Dasyneura communis, gouty vein midge. Galls on maple leaves, Hartford, June 1; Manchester, July 6.

Datana integerrima, walnut caterpillar. Abundant locally on black walnut, Hamden, July 28; South Meriden, Aug. 2.

Diapheromera femorata, walkingstick. Adult, New Haven, Sept. 1.

Shade and Forest Tree Insects—(*Continued*)

Name — Locality, host, date and remarks

Diaspis carueli, juniper scale. On juniper, Hamden, June 1; Easton, June 28. Abundant at Lakeville, according to Dr. E. P. Felt.

Dichelonyx elongata, a small Scarabaeid beetle. Adults on walnut, Bridgeport, June 7.

Diprion polytomum, European spruce sawfly. Less abundant than in 1936.

Diprion simile, introduced pine sawfly. Cocoons on white pine, New Haven, Aug. 31.

Dryophanta palustris, succulent oak gall. Galls on oak, Norwalk, May 19; on pin oak, Thompsonville, May 28.

Ennomos subsignarius, elm spanworm. Egg-masses on maple bark, Southington, Feb. 13.

Epinotia signatana, maple trumpet skeletonizer. Damaged maple leaf, Hamden, Sept. 22.

Eriophyes fraxiniflora, ash flower gall. Pomfret Center, July 17.

Eriophyes padi, wild cherry pouch gall. Galls on black cherry, Shelton, May 27.

Eriophyes ulmi, a mite gall on elm. Wooster, Ohio, Aug. 25.

Eriophyes sp., mite galls. On ash, Winsted, June 22; on willow, New Britain, Aug. 14; on willow, Newington, Oct. 6.

Eriosoma americana, woolly elm aphid. On American elm, Mystic, July 3.

Fenusa pumila, birch leaf-mining sawfly. Very abundant on gray birch. Redding Ridge, June 18; East Hartford, July 21; South Kent, Aug. 6; Greenwich, Aug. 11.

Galerucella xanthomelaena, elm leaf beetle. Damaged elm trees in river valleys. Many adults in house, Hartford, May 10; larvae, Manchester, July 15; adults, larvae and pupae, Windsor Locks, July 22; damaged leaves, White Plains, N. Y., Aug. 3; Unionville, Aug. 11.

Galls on elm (a large pouch gall resembling the slippery elm pouch gall, *Pemphigus ulmifusus*). On American elm, New Haven, June 24.

Gossyparia spuria, European elm scale. Riverside, June 9; White Plains, N. Y., Aug. 3.

Grapta interrogationis, violet-tip butterfly. Caterpillars feeding on elm leaves, New Haven, Aug. 26.

Haltica ulmi, green elm beetle. Damaged elm leaves, Unionville, Aug. 11.

Hamadryas antiopa, spiny elm caterpillar, mourning cloak butterfly. Caterpillars on elm, Glastonbury, June 3.

Hemerocampa leucostigma, white-marked tussock moth. Rather scarce. Female and egg-mass on maple, Hamden, Sept. 27.

Hylobius pales, pales weevil. Damaged pine twigs, Darien, May 13.

Hyphantria cunea, fall webworm. Even more scarce than in 1936. Nest and young caterpillars on elm, New Haven, July 15; on mulberry, Darien, Aug. 28; on elm and mulberry, New Haven, Sept. 9; larva, Branford, Sept. 14.

Itonida catalpae, catalpa midge. Damaged catalpa trees in Stamford area, according to Dr. E. P. Felt.

Itycorsia sp., a pine sawfly. Larvae and frass, on red pine, Trumbull, July 26.

Kaliofenusa ulmi, elm leaf miner. Damaged American elm, Mystic, July 3.

Larvae (unidentified). On maple, South Manchester, Aug. 24; in webbed maple leaves, Southington, Sept. 7; East Dummerston, Vt., Sept. 13.

Lasioptera clavula, dogwood club gall. On flowering dogwood, Norwich, May 14.

Lecanium caryae, hickory soft scale. On oak, Hamden, June 1.

Lecanium corni, European fruit scale. On beech, Middletown, May 25; on elm, Colchester, June 8.

Lecanium fletcheri, arborvitae soft scale. On arborvitae, Thompsonville, June 5; Guilford, June 7.

Shade and Forest Tree Insects—(*Continued*)

Name — Locality, host, date and remarks

Lepidopterous larvae (unidentified). In spruce aphid galls, Hamden, Sept. 23; on folded leaf, East Lyme, Oct. 7.

Lepidosaphes ulmi, oyster-shell scale. On poplar, New Haven, June 8.

Macrodactylus subspinosus, rose chafer. Adults damaged walnut leaves, Bridgeport, June 7.

Malacosoma americana, tent caterpillar. Abundant locally but less prevalent generally than for the past three years. In Bloomfield, East Granby and Windsor the nests were extremely abundant and were present on birch, oak and pine, trees that are not commonly infested.

Malacosoma disstria, forest tent caterpillar. Present locally but less prevalent than in 1936. Caterpillars, Litchfield, June 17.

Midge galls (unidentified). On maple, Southington, May 28; on white oak, New Hartford, Aug. 24.

Mites (unidentified). Eggshells on European white birch, Ansonia, May 18; on oak, Bridgeport, Aug. 18; on white oak, New Hartford, Aug. 24; on paper birch, Hartford, Oct. 5; on mountain ash, Newington, Oct. 6.

Monarthrum fasciatum, a bark beetle. Adults in bark of copper beech, Old Lyme, July 22.

Nacophora quernaria, a large Geometrid moth. Caterpillar, Manchester, Sept. 20.

Neoclytus acuminatus, a long-horned beetle. Adults in houses, probably emerged from fuel wood, West Newton, Mass., Mar. 1; Orange, Mar. 1; Milford, Mar. 10; Hartford, Apr. 28.

Neodiprion lecontei, red-headed pine sawfly. Larvae on white pine, New Haven, Oct. 1.

Neodiprion pinetum, black-headed pine sawfly. Larvae on pine, Meriden, Sept. 14.

Neoprociphilus aceris, woolly maple aphid. On sugar maple, New Canaan, June 17.

Neuroterus batatus, oak potato gall. Galls on oak, Norwalk, June 17.

Neuroterus papillosus, oak blister wasp. Galls on oak, Norwalk, June 17.

Osmoderma eremicola, a Scarabaeid beetle. Larvae in oak, New Haven, Aug. 31.

Paralechia pinifoliella, pine tube moth. Reported as abundant on mugho pine, Westport, May 22, by Dr. E. P. Felt.

Paratetranychus ununguis, spruce mite. On arborvitae, Old Lyme, Apr. 26; on juniper, Hamden, June 1; on Japanese hemlock, Easton, June 28; on Retinospora, Woodbury, Oct. 18; on blue spruce, Hartford, Oct. 22.

Phenacoccus acericola, woolly maple leaf scale. On sugar maple, New London, Aug. 6; Hamden, Sept. 22.

Phyllocoptes quadripes, maple bladder gall. Galls on silver maple, Stamford, May 22; Wallingford, May 28; Washington, June 4; Jewett City, June 8; Litchfield, June 22; Mystic, July 3; on red maple, Washington, June 4.

Phyllophaga sp., a June beetle. Adults defoliated small Japanese and Chinese chestnuts, Bristol, June 18.

Phylloxera caryae-globuli, a hickory leaf-stem gall aphid. Old galls on hickory, Forestville, July 8.

Phylloxera sp. (unidentified). Galls on hickory, Louisiana, May 5.

Phymatodes variabilis, a small long-horned beetle. Adults in houses, probably emerged from fuel wood, New Haven, Feb. 16; Milford, Mar. 10; adults from rustic porch, Guilford, June 3.

Phytophaga rigidae, beaked willow gall. Hamden, Feb. 6.

Pineus strobi, pine bark aphid. On white pine, Darien, May 13.

Shade and Forest Tree Insects—(*Continued*)

Name — Locality, host, date and remarks

Pissodes strobi, white pine weevil. More abundant at Windsor than in 1936. Injured white pine, Greenwich, May 24; Woodbury, June 21; injured spruce, Waterbury, June 21.

Plagiodera versicolora, imported willow leaf beetle. More prevalent than last year on willows along the streams in Fairfield County.

Poecilonota cyanipes ?, a Buprestid beetle. Larva from elm, Westport, Mar. 4.

Prionus laticollis, broad-horned prionus. Adult, Cheshire, July 7.

Prociphilus tessellatus, alder blight. On alder, North Haven, Oct. 20.

Proteoteras moffatiana ?, a twig boring moth. Injured twigs of sugar and sycamore maple, Stonington, July 27.

Pseudococcus sp. (unidentified), a mealybug. On redwood, New Haven, Feb. 9.

Rhabdophaga batatus, willow potato gall. Reported by Dr. E. P. Felt as somewhat injurious on willow, New Canaan.

Rhyacionia buoliana, European pine shoot moth. More prevalent than usual in the Stamford region according to Dr. E. P. Felt. Larvae in shoots of red pine, Waterbury, Dec. 9, 1936; Hartford, Aug. 17.

Saperda tridentata, elm borer. Adults in houses, probably emerged from fuel wood, Litchfield, June 14; New Haven, Sept. 15.

Sawfly larvae (unidentified). On Austrian pine, Kent, June 3.

Scolytus quadrispinosus, hickory bark beetle. Characteristic injury to hickory leaf stems, Norwalk, June 4.

Squirrel damage. Elm twigs cut off for the seeds, Sea Cliff, N. Y., May 26; Wallingford, June 1.

Stilpnotia salicis, satin moth. Larvae defoliated poplar and willow in Bridgeport, according to P. A. Stanley.

Tetralopha robustella, a Pyralid moth. Empty frass balls on red pine, Norwich, Feb. 24; Glastonbury, Apr. 30; Niantic, May 26; on pitch pine, Westport, Apr. 24.

Thyridopteryx ephemeraeformis, bagworm. Locally abundant in Stamford, according to Dr. E. P. Felt. Larvae on maple, Stamford, Aug. 10.

Toumeyella liriodendri, tulip tree scale. On magnolia, Hamden, Aug. 3.

Xylotrechus colonus, a long-horned beetle. Adults in houses, probably emerged from fuel wood, West Newton, Mass., Mar. 1; Hartford, Mar. 12.

Zeuzera pyrina, leopard moth. Galleries in elm, West Haven, Apr. 12.

Insects of Ornamental Shrubs and Vines

Alypia octomaculata, eight-spotted forester. Adults, New Haven, June 2.

Brachyrhinus sulcatus, black vine weevil. Damaged *Taxus cuspidata* plants, Greenwich, June 10; Easton, June 28; damaged Taxus plants, Newtown, July 29.

Chionaspis euonymi, euonymus scale. Damaged various species of euonymus. New Haven, Apr. 21, May 14; Hamden, Aug. 2; Ansonia, Sept. 7; Bethel, Sept. 8; Hartford, Sept. 10; Thompsonville, Oct. 13; Hampton, Oct. 23.

Datana major, a Notodontid moth. Larvae feeding on Andromeda, Bridgeport, July 31.

Dichomeris marginellus, juniper webworm. Webbed twigs of Irish juniper, Stepney, July 7.

Formica fusca subsericea, a common black ant. Damaged and killed small nursery trees in Stamford, according to Felt and Bromley.

Insects of Ornamental Shrubs and Vines—(*Continued*)

Name — Locality, host, date and remarks.

Gracilaria syringella, lilac leaf miner. Characteristic mines in lilac leaves, Branford, Aug. 11.

Gypona sp. (unidentified), a large leafhopper. On rhododendron, Easton, June 28.

Hormaphis hamamelidis, a witch-hazel gall aphid. Galls on witch-hazel, New Haven, June 14.

Lepidosaphes ulmi, oyster-shell scale. On lilac, Westport, Apr. 9; Wallingford, May 12; Woodbridge, June 7; on hawthorn, Darien, Aug. 5.

Macremphytus sp. (unidentified), a dogwood sawfly. Larvae on Cornus or dogwood, Wilton, Aug. 2; Bridgewater, Aug. 2; Bethel, Aug. 14; New Haven, Sept. 8.

Macrodactylus subspinosus, rose chafer. Reported by Dr. E. P. Felt as damaging various shrubs and plants, Darien.

Mite injury. On boxwood, Old Lyme, Apr. 26.

Monarthropalpus buxi, boxwood leaf miner. Damaged leaves, New Haven, June 11; White Plains, N. Y., Aug. 3.

Omphalocera dentosa, barberry webworm. Cocoons and webs on barberry, Branford, Sept. 14.

Pholus pandorus, pandorus sphinx. Larva on Boston ivy, New Haven, Aug. 30.

Phytomyza ilicis, holly leaf miner. Mined leaves, Norwalk, June 4. Reported as causing serious damage to holly in Greenwich, May 22, by Dr. E. P. Felt.

Podosesia syringae, lilac borer. Tunneled lilac twigs, Bethany, May 18.

Poecilocapsus lineatus, four-lined plant bug. Damaged forsythia leaves, New Haven, June 14, 30.

Pseudocneorrhinus setosus, a weevil from Japan. Adults injured various shrubs, New Haven, June 26.

Pseudococcus sp. (unidentified), a mealybug. Said to be on fir tree (probably Taxus), Hamden, July 10.

Psyllid damage (no insects). On boxwood, New Haven, June 11; White Plains, N. Y., Aug. 3.

Saperda candida, round-headed apple borer. Damaged Cotoneaster stems in Darien, and reared in numbers according to Felt and Bromley.

Sesia rhododendri, rhododendron borer. Occurrence in rhododendron in Stamford, reported by Dr. E. P. Felt.

Slug caterpillar (unidentified). On dogwood, Lake Zoar, Aug. 30.

Sphecodina abbotii, Abbot sphinx. Larvae, on Boston ivy, New Haven, July 21; Thompsonville, July 22; on grape, New Haven, July 24.

Stephanitis rhododendri, rhododendron lacebug. Common on rhododendron and mountain laurel in nurseries. On rhododendron, Easton, June 28; Westport, July 27; New Britain, Aug. 5; New London, Aug. 30; Bantam, Sept. 3.

Insects of Flowers and Greenhouse Plants

Aphids (unidentified). On chrysanthemum, Middletown, Dec. 16, 1936.

Autoserica castanea, Asiatic garden beetle. Adults damaged various flower and vegetable plants. Adults, Stamford, July 14; New Haven, July 26, 28; Hamden, July 28; Darien, Aug. 10.

Calomycterus setosus, a weevil from Japan. Present in Sharon, Stratford, Fairfield and Greenwich.

Insects of Flowers and Greenhouse Plants—(*Continued*)

Name — Locality, host, date and remarks.

Diabrotica duodecimpunctata, spotted cucumber beetle. Adults devoured petals of white and yellow dahlias, Bridgeport, Oct. 4.

Lepidopterous larvae (unidentified). On chrysanthemum, New Haven, Oct. 6.

Limax maximus, giant garden slug. Specimens, Middletown, June 30; New Haven, Aug. 14.

Macronoctua onusta, iris borer. Larvae in iris rootstocks, New Haven, July 23; Hamden, Aug. 17.

Nematodes (unidentified). Eelworms damaged madonna lily, Windsor, July 15.

Nodonota puncticollis, rose leaf beetle. Adults on rose, New Haven, June 7; Waterbury, June 26.

Odontocorynus scutellum-album, a weevil. On Helenium, Newtown, Aug. 30.

Pachystethus lucicola, light-loving grapevine beetle. Adults on rose, Hartford, July 8.

Phytomyza minuscula, a columbine leaf miner. Mined leaves, Hamden, July 9.

Poecilocapsus lineatus, four-lined plant bug. Unusually prevalent. Injured chrysanthemum, New Haven, June 9; Woodbridge, June 14; Mystic, July 3; Hamden, July 9; Watertown, July 15; on tansy, New Haven, June 9; on coreopsis, Noroton, July 7.

Popillia japonica, Japanese beetle. Adults damaged many flowering plants, chiefly rose, dahlia, hollyhock and zinnia. Adults, New Haven, July 8, 19, 20, 28, Aug. 2, 5, Sept. 9; Hartford, July 26; Hamden, July 28.

Pyrausta nubilalis, European corn borer. Severely injured dahlia plants. Larvae in gladiolus stalks, Westport, Aug. 18; in dahlia stalks, New Haven, Sept. 27.

Rhizoglyphus hyacinthi, bulb mite. Damaged Easter lily, North Haven, Feb. 9; in tulip bulbs, Waterbury, May 8; in madonna lily, Windsor, June 15.

Sibine stimulea, saddle-back caterpillar. Larvae on dahlia, Derby, Sept. 2; on rose, Milford, Sept. 13.

Taeniothrips simplex, gladiolus thrips. Less troublesome than for several years. Woodbridge, Aug. 4, 20; Lakeville, Aug. 18; Yalesville, Sept. 27.

Tarsonemus pallidus, cyclamen mite. Normally troublesome on larkspur. On heliotrope, Chelmsford, Mass., Jan. 22; on larkspur, Hamden, May 27, June 7; Woodbury, June 3, 26; Middlebury, June 17; Salisbury, June 23; on larkspur and monkshood, Deep River, Aug. 13.

Tetranychus bimaculatus, red spider. On chrysanthemum, New Haven, Aug. 6.

Thrips (unidentified). On marguerite plants in greenhouse, Norwalk, Feb. 17; on chrysanthemum, Woodbridge, June 15.

Insects Infesting Stored Food Products

Lasioderma serricorne, cigarette beetle. Adults from fossil coverings of flour paste in museum, New Haven, Dec. 14, 1936; adults in cloves, New Haven, Sept. 22.

Oryzaephilus surinamensis, saw-toothed grain beetle. Many adults in house, Norwichtown, Jan. 4; Norwich, Oct. 14.

Plodia interpunctella, Indian-meal moth. Adults in house, New Haven, Feb. 18.

Ptinus fur, white-marked spider beetle. Adults in gold fish food, South Meriden, Dec. 29, 1936.

Sitodrepa panicea, drugstore beetle. Adults, New Haven, Aug. 16, Sept. 20; Hartford, Sept. 4.

Tenebrio obscurus, dark meal worm. Larva in house, Greenwich, May 14.

Insects Infesting Stored Food Products—(*Continued*)

Name — Locality, host, date and remarks

Tribolium confusum, confused flour beetle. Adults in gold fish food, South Meriden, Dec. 29, 1936.

Troctes divinatoria, book-louse. Adults in gold fish food, South Meriden, Dec. 29, 1936.

Household Insects

Anthrenus scrophulariae, carpet beetle. Larva from State Health Laboratory (origin unknown), Hartford, May 19; larvae in clothing, Darien, June 7; larva in clothing, Woodmont, June 9; larva in house, North Haven, Aug. 27.

Anthrenus verbasci, museum beetle. Larva in house, New Haven, Feb. 23; adults in house, Norwichtown, Mar. 30; larva, Greens Farms, May 15.

Ants (too badly crushed for identification). Winged adults in house, Darien, Dec. 9, 1936; winged adults, Wilton, June 30.

Attagenus piceus, black carpet beetle. Very prevalent in houses and specimens received 11 times from 8 towns. Larva in house, Hartford, Dec. 16, 1936; larvae, New Haven, Jan. 19; Shelton, Mar. 2; Meriden, Mar. 20; West Haven, Apr. 24; North Haven, Aug. 27; cast skin in orange juice, New Haven, Apr. 17; larva and adult, New Haven, May 25; adults, Hartford, June 9; Hamden, June 29.

Blatta orientalis, Oriental cockroach. Adults, Danbury, July 22.

Blattella germanica, German cockroach. Adults in house, East Hampton, Aug. 3.

Brachyrhinus ovatus, a strawberry root weevil. Adults in house, Hartford, July 23.

Cartodere costulata, a Lathridid beetle. Adults overrunning a dwelling house that had been closed in Stamford, according to Dr. E. P. Felt.

Coninomus constrictus, a Lathridid or minute brown scavenger beetle. Adults, numerous in house, New Canaan, Jan. 22.

Dermestes cadaverinus, a Dermestid beetle. Adults from house with built-in incinerator, New Haven, Feb. 8.

Dermestes lardarius, larder beetle. Adult in house, Woodmont, May 5.

Dermestes sp. (probably *lardarius*). Larva, Hartford, July 24.

Dipterous larvae (unidentified). In house, New Haven, Aug. 10; from refuse in cellar, Derby, Aug. 11.

Gryllus domesticus, house cricket. Many adults and nymphs from houses and a dump, Hartford, June 30.

Lasius sp. Ants in house, Hamden, Apr. 9; Fairfield, May 3.

Microlepidoptera (too badly worn for identification). Two small moths, Darien, June 30.

Parcoblatta virginica, a native woodland cockroach. Adult in house attracted by lights, Hamden, July 7.

Periplaneta americana, American cockroach. Adult in apartment house, New Haven, Oct. 4.

Silverfish (too badly battered for identification). Adults in houses, West Haven, Apr. 24; Hartford, July 30; Mystic, Oct. 5; damaged wall paper, Old Lyme, June 16; Morris, Aug. 31.

Tetramorium caespitum, pavement ant. In houses. Received 10 lots from 5 localities. Workers, Hartford, Dec. 7, 1936; Carteret, N. J., Mar. 17; New Haven, Apr. 9, May 10, 21, June 15; Branford, Apr. 14; Hamden, May 18, June 16; Wilton, Sept. 7.

Tineola biselliella, webbing clothes moth. Larvae from stuffed furniture, Sterling, Feb. 7.

Troctes pulsatoria, a Corrodentid. In house, Litchfield, Sept. 14.

Insects Infesting Timbers and Wood Products

Name — Locality, host, date and remarks.

Callidium sp. (unidentified). Larvae and section of tunneled wood from rustic bench, Milford, Oct. 26.

Camponotus herculeanus pennsylvanicus, black carpenter ant. In all, 10 lots from 6 localities. Adults in house, East Haven, Mar. 17; adults, New Haven, Apr. 12, June 8, July 1, Sept. 27; adults, Hamden, July 8, Oct. 18; adult, Danielson, June 5; winged female, Caanan, June 8; adults in house, Waterford, Sept. 7.

Powder-post beetles (unidentified). Damaged wood, West Cornwall, Apr. 24; Hartford, May 10; Middletown, Sept. 30; Mystic, Oct. 5.

Prionus laticollis, broad-horned prionus. Larva in old apple tree, New Haven, Nov. 4, 1936.

Pseudolucanus capreolus, stag beetle. Larva in old apple tree, New Haven, Nov. 4, 1936.

Reticulitermes flavipes, eastern subterranean termite. In all, 26 lots from 16 localities. Insects or damaged wood, mostly from buildings, New Haven, Feb. 24, Apr. 7, 29, May 1, 13, June 8, July 6; Hamden, Feb. 9, May 26, June 2, July 24; East Haven, Mar. 22; East Canaan, Apr. 20; West Cornwall, Apr. 24; Berlin, Apr. 30; Westport, May 5; Roxbury, May 10; Hartford, May 19, 26; West Haven, May 24; Northford, July 8; Meriden, Sept. 3; Fairfield, Sept. 14; Greenwich, Sept. 23; Wallingford, Oct. 14; Windsor Locks, Oct. 15.

Rhagium lineatum, a long-horned beetle. Pupal cells in pine logs in a log cabin, Hartford, July 19.

Solenius sp., a wood-boring wasp. Only males present and females are required for specific identification. Adults in decayed wood of porch, New Haven, Aug. 31.

Stephanopachys rugosus, a Bostrichid beetle. Adult from timber, Woodbridge, July 19.

Xestobium rufovillosum, death-watch beetle. Damaged wood from house, Hamden, July 24.

Insects of Soil and Lawn

Andrena asteris, a ground-nesting bee. Many sand piles formed on lawns. Adults, West Haven, Sept. 20; Danbury, Sept. 21.

Anomala orientalis, Asiatic beetle. Spreading slowly. Grubs in lawn, New Haven, May 4, 17; June 16, July 1, Aug. 25, 27, Sept. 21, 23, Oct. 4, 29; Bridgeport, May 7; Greenwich, Aug. 18; Hartford, Sept. 23; adult, on rose, New Haven, July 19.

Aphids (unidentified). Tan colored aphids on roots of lawn grass, Milford, June 30.

Autoserica castanea, Asiatic garden beetle. Spreading rather rapidly. Grubs in lawns, New Haven, Apr. 27, May 20, Sept. 14, 23; Greenwich, July 31; Bridgeport, Oct. 15; adults, New Haven, Aug. 20; Noroton, Aug. 14; Groton, Aug. 24.

Beetle (unidentified). Adult, from lawn, West Hartford, July 1.

Blissus hirtus, hairy chinch bug. Nymphs and adults in lawns, West Hartford, July 1; Danbury, July 14; Bristol, Aug. 7; New Haven, July 3, Aug. 28, Sept. 2, 9.

Geophilid (unidentified), a millipede. Immature specimens in the soil of a potted plant, Danielson, Feb. 11.

Grubs (unidentified). In soil from sifting, Windsor, Apr. 9.

Julus hortensis, garden millipede. Adult in lawn, Hamden, Sept. 29.

Lasius sp. (unidentified), an ant. In lawn, Waterbury, Aug. 28; in garden, Stamford, Oct. 22.

Lepidopterous larvae (unidentified). In lawn, Hamden, Sept. 29; Noctuid larva, Greenwich, Oct. 6.

Insects of Soil and Lawn—(*Continued*)

Name — Locality, host, date and remarks

Ochrosidia villosa, a native Scarabaeid beetle. Severely injured three acres of lawn, East Norwalk, Sept. 13; grubs, Greenwich, Oct. 6; many adults, Southport, Oct. 22.

Odontaeus filicornis, a Scarabaeid beetle. Adult from golf green, Winsted, June 30.

Phyllophaga tristis, a small June beetle. Adult, under shrubs, Shelton, Apr. 29.

Phyllophaga sp. (unidentified), June beetle. Adult, from golf course, Farmington, May 12; grubs, Woodbridge, Sept. 2; Hartford, Sept. 23.

Pleurophorus caesus, a Scarabaeid beetle. Adult in lawn, Greenwich, July 1.

Polygria sp. (unidentified), young land snails believed to cause brown spots on lawn, Guilford, May 19.

Popillia japonica, Japanese beetle. More prevalent than ever before in Connecticut. Grubs, New Haven, Apr. 27, May 20, Sept. 14, 23; adults on grass in field, East Hartford, July 30; adults in wheat grain, Woodmont, Aug. 24; adults, Greenwich, Sept. 11.

Protosphex ichneumonea, a large solitary Sphecid wasp. Adults from lawn, Hartford, July 14.

Solitary wasp (unidentified). Adult from lawn, West Haven, July 30.

Sphecius speciosus, cicada killer. Adults, in yard, New Haven, July 19, Aug. 17; Hartford, Aug. 6; Brooklyn, Aug. 16; Waterford, Aug. 27.

Springtail (unidentified), small Thysanurid. Specimens in soil of a potted plant, Danielson, Feb. 11; perhaps a different species, in soil, Milford, Apr. 8.

Tibicen canicularis, a cicada. Pupa from lawn, New Haven, July 1; adults, New Haven, Aug. 17, Sept. 3.

Insects Annoying Man and Domestic Animals

Cimex lectularius, bedbug. One specimen from house, Hamden, June 29; many specimens of various sizes from house, West Haven, July 12; chicken house heavily infested, Milford, Sept. 7.

Ctenocephalides canis, dog flea. Adults in house, Westport, Nov. 7, 1936; from cat, Shelton, Apr. 3; specimens, East Hampton, Aug. 11; from garden, East Hartford, Aug. 26; from cellar, Windsor Locks, Aug. 31; specimens, Waterbury, Sept. 1; from house, Greenwich, Sept. 3.

Ctenocephalides sp. (unidentified), fleas. On dog and in house, Guilford, July 26; from house, Hamden, Aug. 19.

Culex pipiens, house or rain barrel mosquito. Adults from Canada, Sept. 9.

Dermacentor variabilis, dog tick. Adult from human scalp, Stratford, July 1.

Riphicephalus sanguineus, a tick. Adult and immature specimens from dog and in cracks of wood finish, New Haven, Aug. 19.

Spiders

Heteropoda venatoria, huntsman spider. Adult, probably came on bananas, New Haven, July 13.

Phidippus audax, a jumping spider. New Haven, May 26, June 15.

Beneficial Insects

Adalia bipunctata, two-spotted ladybeetle. Adults in house, Bethany, Jan. 13; North Guilford, Jan. 16.

Beneficial Insects—(*Continued*)

Name — Locality, host, date and remarks

Adalia humeralis, a ladybeetle. Adult in house, North Guilford, Jan. 16.

Amara sp. (unidentified), a ground beetle. In lawn, Greenwich, Sept. 3.

Anatis quindecimpunctata, fifteen-spotted ladybeetle. Adults, Hartford, June 1.

Calosoma scrutator, caterpillar hunter. Adult, Waterford, July 12.

Carabid or ground beetle (unidentified). Larva in soil, Hamden, May 4; several adults in cat's and dog's feeding dish, Hamden, July 30.

Chilocorus bivulnerus, twice-stabbed ladybeetle. Adults on pear tree, Woodmont, May 27; larva in house, Wilton, July 2; pupae on Scotch pine, Cannondale, July 13; pupa skins, Deep River, Aug. 4; adults, Greenwich, Aug. 4.

Hyperaspis signata, a small ladybeetle. Adults, Hamden, Sept. 22.

Lebia viridis, a small Carabid or ground beetle. Adult, South Meriden, Dec. 29, 1936.

Megarhyssa lunator, lunate long-sting. Adults, on English walnut, New Haven, June 14.

Microweisia misella, a small ladybeetle. Adults under bark of a scale-infested tree, West Haven, Dec. 30, 1936.

Scymnus flavifrons, a small ladybeetle. Adult, South Meriden, Sept. 14.

Tachinid fly (crushed and unidentified), a parasite of the spiny elm caterpillar, Meriden, July 6.

Tenodera sinensis, Chinese mantid. More common than usual. Adults, Orange, Sept. 3; West Haven, Sept. 13; New Haven, Sept. 16; 2 adults and at least 25 in near vicinity, South Norwalk, Oct. 9.

Miscellaneous

Acrosternum hilaris, green stink bug. Adult in woodland, North Branford, Mar. 1.

Ampelophaga choerilus, a sphinx moth. Adult, New Haven, Sept. 1.

Aplodes mimosaria, a small Geometrid moth. Adult, New Haven, Sept. 1.

Automeris io, io moth. Caterpillar, Branford, Sept. 14.

Basilarcha astyanax, purple butterfly. Adult, Branford, Sept. 30.

Ceutorhynchus cyanipennis, a weevil that infests the seeds of cruciferous plants. Several adults, South Meriden, Dec. 29, 1936.

Chauliodes angusticollis, a fish fly. Adult, Derby, Aug. 23.

Corydalis cornuta, dobson fly or hellgramite. Adult male, Guilford, July 3.

Catalpa lanigera, goldsmith beetle. Adult, New Haven, June 3.

Cressonia juglandis, walnut sphinx. Adult, Tylerville, July 16.

Dendroleon obsoletum, an ant lion. Adult, Wallingford, Aug. 18.

Deromyia umbrina, a robber fly. Adult, New Haven, Aug. 2.

Diacrisia virginica, virgin tiger moth. Caterpillars, Branford, Sept. 14.

Dipterous larvae (unidentified). In garbage can, Newtown, Aug. 30.

Enchenopa binotata, two-marked treehopper. Adults, Danbury, July 30.

Eristalis tenax, drone fly. Larvae in mud at base of drinking fountain, Hartford, July 14.

Fucellia maritima, an Anthomyid fly. Adults, on beach at seashore, Fairfield, Nov. 9, 1936.

Fumea casta, a Psychid moth. Empty cases on building, New Haven, Sept. 3; cocoon on leaf, Branford, Sept. 14.

Gasteruption sp. (unidentified), a Hymenopterous insect. The species of this genus are parasites of bees. Adult, South Meriden, Dec. 29, 1936.

Miscellaneous—(*Continued*)

Name	Locality, host, date and remarks.

Glischrochilus fasciatus, a sap beetle. Adult on pear tree, Woodmont, May 27.

Gordius robustus, a hair worm or hair snake. In water in a well, Branford, Jan. 2.

Hagenius brevistylus, a may fly. Cast skin on pine tree near water, Guilford, Sept. 2.

Haploa clymena, a tiger moth. Adult, Hamden, Aug. 18.

Junonia coenia, the buckeye butterfly. Adult, Branford, Aug. 20.

Lepidopterous larvae (unidentified). In cup cake in a store, New Haven, Oct. 19.

Lethocerus americanus, giant water bug. Adult around electric light, Hamden, May 6.

Magicicada (*Tibicen*) *septendecim*, periodical cicada. Brood XI appeared in Willington and was observed by Prof. J. A. Manter.

Myrmeleon immaculatus, an ant lion. Larvae, Hamden, Sept. 27.

Necrophorus americanus, a carrion beetle. Adult, Cheshire, July 3, 20.

Necrophorus pustulatus, a carrion beetle. Adult, Cheshire, July 20.

Orthosia bicolorago var. *ferruginoides*, a common Noctuid moth. Adult, Pierce Bridge, N. H., Oct. 21.

Paederus litorarius, a Staphylinid beetle. Adults, South Meriden, Dec. 29, 1936.

Panchlora cubensis, a tropical green cockroach. Adult in sealed package of shredded wheat, Bristol, Nov. 30, 1936; adult in lettuce, Waterbury, Mar. 9.

Paonias excaecatus, a sphinx moth. Adult, New Haven, Sept. 1.

Papilio glaucus var. *turnus*, tiger swallow-tail butterfly. Caterpillar, Portland, July 23.

Papilio thoas (*cresphontes*), orange dog butterfly. One adult in flight was observed in the writer's garden, and two specimens in New Canaan, Aug. 12, 15, were reported by Whitman Bailey.

Papilio troilus, green clouded swallow-tail butterfly. Caterpillars on spicebush, Woodbury, Sept. 2; Branford, Sept. 14.

Phorid flies (unidentified). Several adults crushed in letter from house, South Norwalk, Dec. 2, 1936.

Pleurotropis tarsalis, a Hymenopterous parasite. From pupae of a small ladybeetle, *Scymnus flavifrons*, South Meriden, Sept. 14.

Podabrus rugulosus, a Telephorid beetle. Adult in house, Darien, June 30.

Polydrusus sericeus, a small weevil. Adult in house, Darien, June 30.

Psocids (unidentified). On elm tree, Manchester, July 15; on side of barn, Sound View, Aug. 2.

Plecticus trivittatus, a Stratiomyid fly. Adult, Hamden, Aug. 18.

Sawfly (too badly crushed for identification). Adult, New Canaan, May 27.

Scenopinus fenestralis, a small fly. Adult, Greens Farms, May 25.

Scheloribates lanceoliger, a beetle mite. Cleveland, Ohio, Sept. 28. (Det. by A. P. Jacot)

Schinia arcifera, a Noctuid moth. Adult, Branford, Oct. 7.

Sibine stimulea, saddle-back caterpillar. Larvae on corn, New Haven, Aug. 24; on dahlia, Derby, Sept. 2; on rose, Milford, Sept. 13.

Silpha americana, a carrion beetle. Adult, Cheshire, July 20.

Sow bug (unidentified), a Crustacean. In cavity in oak tree, New Haven, July 7.

Spirobolus platytops, a large millipede. In sisal from Mexico, Plymouth, Mass., June 18.

Syrphid flies (broken and not identified). Adults on boat between Port Jefferson, L. I., and Bridgeport, July 22.

Miscellaneous—(*Continued*)

Name	Locality, host, date and remarks.

Tarpela micans, a Tenebrionid beetle. Many adults under burlap bands in gypsy moth control, Danielson, July 16.

Telephanus velox, a Cucujid beetle. Adults in grass under super in apiary, Norwichtown, Jan. 4.

Tipula trivittata, a crane fly. Adult on lawn, New Haven, June 14.

Tolype velleda, a lappet moth. Adult, Branford, Oct. 7.

Uranotes melinus, gray hair-streak butterfly. Adults, Branford, Aug. 30.

Zetes eliminatus, a beetle mite. Cleveland, Ohio, Sept. 28. (Det. by A. P. Jacot)

CONFERENCE OF CONNECTICUT ENTOMOLOGISTS

The fourteenth annual conference of entomologists working in Connecticut was held in the Assembly Room at the Connecticut Agricultural Experiment Station, New Haven, Conn., on Thursday, October 28, 1937, beginning at 10 A.M. Dr. Philip Garman was elected chairman, and 109 persons were present. Luncheon was served by members of the Entomology Department staff.

The following program was carried out in full:

Greeting, Director Wm. L. Slate, New Haven, Conn.

Some Entomological Features of 1937, W. E. Britton, New Haven, Conn.

Shade Tree Insect Developments in 1937, E. P. Felt and S. W. Bromley, Stamford, Conn.

The European Spruce Sawfly Situation in the United States in 1937 (lantern slides), H. J. MacAloney, U.S.D.A., New Haven, Conn.

Preliminary Work with European Spruce Sawfly Parasites in the United States, P. B. Dowden, U.S.D.A., New Haven, Conn.

A Review of the Japanese Beetle Situation (lantern slides), C. H. Hadley, U.S.D.A., Moorestown, N. J.

Report on the Federal Gypsy Moth and Brown-Tail Moth Work, A. F. Burgess, U.S.D.A., Greenfield, Mass.

Recent Developments in Insecticidal Control of the European Corn Borer (lantern slides), C. H. Batchelder, U.S.D.A., and Neely Turner, New Haven, Conn.

Some Motion Picture Records of Connecticut Insects, Prof. A. L. Melander, New York, N. Y.

The Periodical Cicada; Occurrence of Brood XI in Connecticut in 1937 (lantern slides), Prof. J. A. Manter, Storrs, Conn.

Notes Concerning Some of the Stalk Borers of Connecticut, Henry Bird, Rye, N. Y.

Some Observations on the Larval Instars of Hylurgopinus in Massachusetts W. B. Becker, Amherst, Mass.

Further Observations on the Control of the Apple Maggot and the European Red Mite (lantern slides), Philip Garman, New Haven, Conn.

Control of the Carpenter Ant in Telephone Poles (lantern slide), R. B. Friend, New Haven, Conn.

Damage to Houses by Powder-Post and Anobiid Beetles (lantern slides), Neely Turner, New Haven, Conn.

INSPECTION OF NURSERIES, 1937

W. E. Britton and M. P. Zappe

On July 1, 1937, Mr. Zappe, assisted by A. F. Clark, W. T. Rowe and R. J. Walker, commenced the annual inspection of nurseries, as provided in Section 2136 of the General Statutes. Messrs. Clark, Rowe and Walker worked during July and August and helped inspect most of the larger nurseries. The others were inspected during September by Mr. Zappe, assisted at different times on certain trips by Neely Turner, B. J. Kaston and J. P. Johnson. A few nurseries were visited the second and third times to make sure that the pests had been eradicated.

Altogether, the nurseries were in better condition than in 1936, although some had been neglected. The oyster-shell scale, San José scale and pine leaf scale were somewhat less prevalent than in 1936, but the spruce gall aphids, white pine weevil and European pine shoot moth were slightly more prevalent. There were 25 nurseries in which no pests were found. Altogether, about 111 different insect pests, and 67 different plant diseases were found in nurseries in 1937. These cannot all be mentioned here but some of the more important pests that may be carried on nursery stock are shown with the number of nurseries infested by each for the past 10 years, in the following table:

Table 1. Ten-Year Record of Certain Nursery Pests

Pest	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
Oyster-shell scale	57	78	86	73	68	78	104	93	87	84
San José scale	30	22	8	11	10	13	19	17	11	8
Spruce gall aphids[1]	120	147	99	124	141	231	244	285	337	306
White pine weevil	19	37	66	74	70	61	67	98	82	101
Pine leaf scale	13	13	10	20	26	46	66	42	72	60
European pine shoot moth	7	7	17	32	77	137	120	121	108	128
Poplar canker	35	37	35	23	40	34	39	28	28	26
Pine blister rust	5	7	7	13	12	11	7	2	0	4
Nurseries uninfested	18	13	18	32	24	22	21	16	26	25
Number of nurseries	228	266	302	327	351	362	381	373	380	377

Number and Size of Nurseries

The list of nurserymen for 1937 contains 377 names, a decrease of three below 1936. A classification of nurseries by size may be indicated as follows:

Area	Number	Percentage
50 acres or more	20	5
10 acres to 49 acres	43	11
5 acres to 9 acres	30	8
2 acres to 4 acres	97	26
1 acre or less	187	50
	377	100

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

Of the 377 nurseries listed for 1937, six new nurseries were registered and inspected before the spring shipping season and again in late summer. These are marked "(2)" after the name because each was inspected twice and granted two certificates during the year.

Twelve nurserymen failed to register before July 1, 1937, and, as provided in Section 2137 of the General Statutes, must pay the cost of inspection. A minimum fee of $5.00 was charged in each case. Nine have paid and $45.00 was turned over to the Treasurer of the Station to be sent to the State Treasurer.

The area of Connecticut nurseries receiving certificates in 1937 is 5,001 acres, an increase of 146 acres over last year. Altogether, 21 new names have been added, and 18 have discontinued the nursery business either temporarily or permanently since last year. Some of these registered and some failed to register, and only a few notified the office. Consequently, it was necessary for the inspector to visit the others before learning that they had discontinued the nursery business. Twenty-three nurseries listed in 1936 are on the 1937 list under different names, thus changing the alphabetical arrangement. Five nurseries failed to qualify and receive their certificates on or before December 31, 1937. The nursery list of 1937 contains 377 names, a decrease of three below that of last year. The nursery firms receiving certificates for 1937 are as follows:

Connecticut Nursery Firms Certified in 1937

Name of firm	Address	Acreage	Certificate date	Certificate number
Ackerman, H. S.	West Hartford	2	Sept. 7	3744
Adamcyk, Frank	Deep River	1	Sept. 1	3722
Adamec Evergreen Nursery, George	East Haven	1	Oct. 9	3907
Aldrich Gardens	Guilford	1	Oct. 16	3926
Aldrich, Miss Inie E.	Thomaston	2	Sept. 11	3770
Allara, Emanuel, Estate of	Hamden	1	Sept. 24	3847
Allen, Henry L.	Pawcatuck	1	Sept. 9	3757
Anderson Avenue Nursery	West Haven	1	Sept. 23	3838
Andover Gardens	Andover	1	Aug. 28	3706
Anstett Nursery, Louis	Norfolk	2	Sept. 30	3871
Arnold of Orange Nursery	Orange	1	Aug. 21	3682
Artistree Nursery	Branford	3	Sept. 23	3842
Austin, M. E.	Clinton	1	Sept. 1	3721
Backiel, Adolf (2)	Southport	1	Sept. 28	3864
Bakhmeteff, Boris A.	Brookfield	10	Dec. 10	3965
Baldwin, Linus	Middletown	1	Sept. 2	3725
Banak Nurseries	New Britain	4	Sept. 24	3853
Barnes Bros. Nursery Co., The	Yalesville	215	Sept. 4	3733
Bartolotta, Mike S.	Cromwell	2	July 26	3622
Barton Nursery	Hamden	1	Oct. 30	3941
Beach, Roy G.	Forestville	1	Aug. 11	3666
Beattie, William H.	New Haven	1	Aug. 24	3693
Bedford Gardens	Plainville	1	Sept. 22	3849
Bedini, Vincent	Ridgefield	3	Dec. 30	3979
Beers, H. P.	Southport	1	Nov. 1	3942
Benbow, Florist, Abram	Norfolk	1	Sept. 18	3810
Beran, Andrew	New London	1	Nov. 29	3958
Berg, Fred	Stamford	4	Nov. 17	3952
Berkshire Gate Nurseries	Danbury	1	Sept. 3	3732

CONNECTICUT NURSERY FIRMS CERTIFIED IN 1937—(Continued)

Name of firm	Address	Acreage	Certificate date	Certificate number
Bertolf Bros., Inc.	Old Greenwich	40	Aug. 28	3705
Biehler, Augusta	Plainville	1	Sept. 22	3836
Blakeslee, Dwight W.	North Haven	1	May 5	3602
Blue Hills Nurseries, Inc.	Hartford	24	Sept. 7	3749
Boggini Nursery, Louis	South Manchester	1	July 20	3614
Bonnie Brook Gardens	Rowayton	2	Dec. 7	3962
Booy, H. W.	Yalesville	4	Oct. 4	3888
Brack Nursery	Brookfield	2	Oct. 1	3874
Brainard Nursery & Seed Co.	Thompsonville	15	Aug. 4	3646
Branford Nurseries	Branford	6	Sept. 13	3781
Bretschneider, A.	Danielson	1	Aug. 26	3702
Bridgeport Hydraulic Co.	Bridgeport	15	Sept. 21	3822
Brimfield Gardens Nursery	Wethersfield	8	Sept. 17	3805
Bristol Nurseries, Inc.	Bristol	65	Aug. 2	3641
Brooklawn Nursery	Bridgeport	2	July 28	3626
Brooks, H. P.	West Haven	1	Oct. 23	3935
Brookside Nurseries	Darien	5	Aug. 6	3650
Brouwer, Jack	New London	4	Sept. 4	3738
Brouwer's Nurseries	New London	20	Sept. 8	3751
Brouwer's Nurseries, Peter	New London	4	Sept. 10	3767
Bureau of Trees	New Haven	7	Aug. 24	3692
Burke the Florist	Rockville	1	July 28	3627
Burnett's Corners Farm, The	Mystic	2	Sept. 9	3758
Burnside Avenue Greenhouse & Nursery	East Hartford	4	Sept. 25	3860
Burr, Morris L.	Westport	1	Oct. 8	3906
Burr & Co., Inc., C. R.	Manchester	500	Aug. 4	3647
Burwell Seed Co., E. E.	New Haven	1	Oct. 2	3882
Byram Evergreen Nursery	East Port Chester	1	Sept. 30	3867
Cardarelli, E. J.	Cromwell	5	July 31	3637
Carlson's Garden Service	Tracy	1	Sept. 21	3828
Cascio, Peter	West Hartford	15	Sept. 16	3798
Case, Mrs. Louis L.	Simsbury	1	Sept. 22	3832
Cherry Hill Nursery, Inc.	Rockfall	50	July 31	3639
Chesman Estate, Joseph	East Haven	1	Oct. 2	3884
Chiapperini, Michele	Groton	1	Sept. 7	3745
Chippendale Nurseries, Inc.	Old Lyme	2	Oct. 29	3939
Choate School, The	Wallingford	4	Oct. 4	3886
Chudy, Peter	Danbury	1	Sept. 11	3774
City Line Florist	Bridgeport	1	Oct. 13	3917
Cleary's Gardens	Bethel	1	Sept. 11	3777
Clinton Nurseries	Clinton	70	Sept. 16	3796
Coley, H. W.	Westport	1	Oct. 6	3891
Conine Nursery Co., Inc.	Stratford	75	July 30	3635
Conn. Agr. Expt. Station (W. O. Filley, Forester)	New Haven	2	July 29	3633
Connecticut Forestry Nurseries	Deep River	17	Sept. 17	3807
Conn. State College (Prof. S. P. Hollister)	Storrs	1	Aug. 30	3712
Conn. State Forestry Department	Hartford	5	Sept. 18	3819
Conn. State Highway Dept. (Bureau of Roadside Development)	Hartford	18	Oct. 8	3903
Connecticut Valley Nurseries	Manchester	25	July 28	3628
Corrigan's West Haven Nursery	West Haven	1	Sept. 23	3841
Courtland Avenue Nursery	Stamford	3	Sept. 15	3794
Cragholme Nurseries, Inc.	Greenwich	2	Sept. 30	3868
Cronamere Alpine Nurseries, Inc.	Greens Farms	6	Aug. 21	3683
Curtiss, C. F.	Milldale	1	Dec. 28	3977

CONNECTICUT NURSERY FIRMS CERTIFIED IN 1937—(Continued)

Name of firm	Address	Acreage	Certificate date	Certificate number
Daisy Hill Gardens	Derby	1	Nov. 2	3944
Dallas, Inc., Alexander	Waterbury	1	Dec. 1	3960
Damen, Peter J.	East Haven	2	Oct. 19	3929
Darien Nurseries	Darien	6	Aug. 21	3684
Daybreak Nurseries	Westport	3	Dec. 8	3964
Dearden Bros.	East Hartford	5	Sept. 24	3850
DeBaise, Pasquale	Wallingford	1	Sept. 30	3872
DeMars Nursery	Winsted	1	Sept. 18	3811
Dewey, V. E. (2)	Groton	2	Dec. 15	3972
Dietrich Nursery, Benj.	Greenwich	4	Dec. 3	3961
Dillon, Thomas	Greenwich	1	Sept. 23	3843
Dingwall, Joseph N.	West Haven	1	Sept. 23	3840
Doane, David F.	Haddam	1	Sept. 11	3771
Doebeli, Charles A.	Bridgeport	1	Dec. 11	3970
Donovan, Dan. H.	Talcottville	1	Aug. 2	3640
Donovan, John N.	Rocky Hill	3	Aug. 9	3653
Drenckhahn, Ernest J.	Cos Cob	10	Aug. 13	3667
Dudley, Grace W.	Guilford	1	Aug. 28	3707
Dunlap's Dollar Evergreens	Cromwell	3	July 28	3629
Dunn, James F.	Stamford	4	Nov. 12	3951
Eager, Edward M.	Bridgeport	1	Sept. 4	3735
East Haven Nursery	East Haven	1	Oct. 2	3883
Edendale Gardens	Winsted	1	Sept. 18	3812
Edgewood Nurseries	New Haven	1	Sept. 23	3839
Elfgren Nurseries	East Killingly	3	Aug. 25	3694
Ellmer, Karl (2)	Cannondale	2	Dec. 30	3978
Ellsworth Nursery, The	Newington	1	Sept. 3	3731
Elm City Nurseries	New Haven	1	Sept. 7	3748
Elmgren Nursery	Cromwell	1	Dec. 8	3963
Elm Grove Cemetery Association	Mystic	1	Sept. 24	3846
Evergreen Nursery Co.	Wilton	30	July 9	3606
Evergreens, The	Southport	2	Sept. 17	3803
Fairway Gardens	Woodmont	1	Sept. 7	3742
Farmington Valley Nursery	Avon	5	Sept. 10	3766
Ferchau, Hugo	Milford	1	Oct. 19	3930
Fletcher, Walter G.	Guilford	5	Sept. 16	3801
Flower City Rose Company	Manchester	23	Aug. 2	3642
Follett Nursery	Westport	10	Aug. 19	3674
Fountain Nurseries	Farmington	10	Aug. 19	3675
Foxon Park Nursery	East Haven	1	Oct. 2	3885
Fraser's Nurseries & Dahlia Gardens	Willimantic	3	Aug. 25	3695
Frede, Wm. Frederick	Danbury	1	Sept. 23	3845
Galligan, C. W.	New Haven	1	Oct. 11	3913
Gallup, Amos M.	Pawcatuck	1	Sept. 9	3759
Garden of Romance, The	Old Saybrook	2	Sept. 16	3799
Gardner's Nurseries	Rocky Hill	300	Aug. 31	3720
Geduldig's, Florist & Nurseryman	Norwich	6	Aug. 30	3713
Giant Valley Nursery	Mount Carmel	1	Aug. 7	3651
Gilbert, Henry G.	Danielson	2	Nov. 18	3953
Glastonbury Gardens	Glastonbury	4	Sept. 15	3788
Glenbrook Greenhouses	Glenbrook	2	Dec. 10	3966
Glenwood Nurseries	Clinton	2	Sept. 25	3855
Glen Terrace Nurseries	Hamden	70	Nov. 24	3956
Godfrey, Stratfield Nursery, George R.	Bridgeport	50	Oct. 21	3934
Golden Hill Nurseries	Shelton	3	Sept. 14	3783
Goodwin Nurseries	Bloomfield	7	Aug. 10	3656

CONNECTICUT NURSERY FIRMS CERTIFIED IN 1937—(Continued)

Name of firm	Address	Acreage	Certificate date	Certificate number
Goshen Nurseries	Goshen	6	Oct. 13	3915
Gosnell, Evelyn	Westport	1	Oct. 23	3936
Great Pond Nursery	Hartford	1	Sept. 22	3833
Green Acre Farms, Inc.	Waterford	1	Aug. 26	3697
Green, Wm. P.	South Windsor	3	Sept. 21	3821
Grillo, N.	Milldale	1	Sept. 24	3854
Griswold, George	Old Lyme	1	Aug. 26	3698
Gunn, Mrs. Charles	Kent	1	Oct. 2	3878
Haas, Florist	Milford	1	Oct. 14	3922
Hall, Henry A. L.	West Haven	1	Sept. 24	3848
Hamden Nursery	Hamden	1	Oct. 8	3901
Hansen's, Florist & Nursery	Fairfield	5	Aug. 20	3679
Hansen's Garden	Newington	3	Sept. 2	3723
Happy Days Farm	Norwalk	10	Aug. 11	3659
Hearn, Thomas H.	Washington	3	Oct. 6	3894
Heath & Company	Manchester	15	July 23	3618
Henninger, Christ.	New Britain	1	Sept. 21	3827
Hettinger, Joseph O.	Manchester	1	Aug. 24	3691
Hildebrand's Nursery	Norwich	1	Aug. 19	3678
Hilding Brothers	Amston	1	Aug. 23	3686
Hillcrest Gardens	Woodbridge	3	July 27	3625
Hilliard, H. J.	Sound View	1	Aug. 26	3699
Hilltop Nurseries	Orange	2	July 20	3615
Hinckley Hill Nursery	Stonington	1	Sept. 9	3760
Hiti Nurseries	Pomfret Center	11	Aug. 20	3680
Hofmann, Wm. T.	Cromwell	2	July 16	3611
Holcomb, Ernest L.	Simsbury	1	Sept. 22	3835
Holcomb's Evergreen Nursery	Winsted	6	Oct. 2	3880
Holdridge & Sons, S. E.	Norwich	3	Aug. 11	3662
Hope Street Nursery	Springdale	1	Sept. 15	3790
Horan, Estate of James F.	Hartford	1	Oct. 7	3896
Horan, Kieran W.	West Hartford	1	Sept. 7	3741
Horowitz, Ben	East Hampton	1	Aug. 11	3663
Hosking, James S.	Watertown	1	Sept. 28	3862
Hotchkiss, H. L.	North Haven	1	Oct. 9	3908
Houston's Nurseries	Mansfield Depot	5	Aug. 30	3715
Hoyt, Charles E.	Bethel	35	Aug. 31	3718
Hoyt's Sons Co.. Inc., Stephen	New Canaan	500	July 27	3624
Hurlburt Nursery	Hamden	1	Oct. 1	3876
Hyatt, Thaddeus	Stamford	10	Nov. 9	3950
Isselee's Sons, Inc., Chas.	Darien	5	Aug. 20	3681
Johnson, Harry L.	South Meriden	1	Sept. 3	3730
Johnson, Tom	Stratford	1	Sept. 4	3737
Kateley, Milton M.	East River	1	Aug. 28	3708
Kelley & Son, James J.	New Canaan	6	Sept. 14	3786
Kellner, Arthur H.	Norwalk	1	Sept. 25	3859
Keogh, Harry W.	Norwalk	1	Dec. 10	3967
Keser's Sons, Inc., Otto	Portland	1	Sept. 2	3727
Key Rock Gardens	Newtown	2	Oct. 4	3887
Lanedale Farm Nurseries	New Canaan	10	Oct. 2	3877
Langstroth Nurseries	Danbury	6	Aug. 11	3664
Laviola, Cosmo	New Haven	1	Nov. 4	3946
Lawrence Greenhouses	Branford	1	Oct. 16	3927
Leghorn's Evergreen Nurseries	Cromwell	27	Aug. 21	3685
Lemmon, Robert S.	New Canaan	1	July 9	3608
Lewis Gardening Service	Kensington	1	Oct. 8	3905

CONNECTICUT NURSERY FIRMS CERTIFIED IN 1937—(Continued)

Name of firm	Address	Acreage	Certificate date	Certificate number
Lewis & Valentine, Inc. (Construction Department)	Darien	9	Aug. 23	3687
Lowescroft Gardens	Manchester	1	July 28	3630
Luce, Mrs. Charles L.	Newington	1	Sept. 3	3729
Luckey, Ada Mae	Greens Farms	1	July 9	3607
Luckner, Jr., William	Stepney	1	Oct. 14	3920
Lynch, Mrs. John H.	Ridgefield	3	Oct. 15	3925
Malleable Iron Nursery	Branford	2	Sept. 16	3800
Maplewood Nursery Co.	Norwich	2	Dec. 31	3980
Marigold Farm	New Canaan	20	Sept. 21	3824
Marlborough Gardens	Marlborough	3	Sept. 2	3728
Massacoe Nursery	Simsbury	3	Oct. 6	3893
Mather Homestead	Darien	1	Sept. 25	3856
Mayapple Nursery	Stamford	1	Oct. 18	3928
McCarthy, John P.	Danbury	1	Sept. 11	3776
McConville's Greenhouses and Nurseries	Manchester	2	July 21	3616
Meier, A. R.	West Hartford	1	Oct. 7	3895
Melville Nurseries	Fairfield	1	Oct. 6	3892
Merwin Lane Nursery	East Norwalk	3	Aug. 11	3660
Meyer Nursery, Ludwig	Bridgeport	4	Oct. 5	3889
Middeleer	Darien	10	Oct. 14	3918
Milford Nursery	Milford	2	July 28	3631
Millane Nurseries & Tree Experts, Inc.	Cromwell	50	Aug. 14	3670
Mill River Nursery	Fairfield	15	Aug. 3	3644
Millstone Garden	Terryville	1	July 29	3634
Minge, G. H.	Rocky Hill	1	Aug. 17	3673
Moore Hill Nursery	Uncasville	1	Aug. 26	3700
Moraio Brothers	Old Greenwich	5	Oct. 8	3904
Morgan & Sons, Wm. F.	North Stonington	3	Sept. 9	3761
Mountain Grove Cemetery Association, The	Bridgeport	1	Sept. 28	3865
Mount Airy Gardens	Stamford	1	Sept. 15	3791
Mount Carmel Nursery	Mount Carmel	1	Nov. 3	3945
Munro, Edward A.	New Haven	1	Oct. 19	3931
New England Water Lily Gardens	Manchester	1	Dec. 18	3974
New Era Seed Co.	Clinton	3	Sept. 16	3797
New Haven Park Commission	New Haven	10	Oct. 14	3919
Newington Gardens & Nurseries	Newington Junction	1	Oct. 8	3899
New London Cemetery Association, The	New London	1	Sept. 10	3768
New London County Nurseries	New London	5	Oct. 14	3921
Newton's Nursery	West Granby	1	Sept. 22	3834
New York, New Haven & Hartford R. R. Co.	Bridgeport	4	Sept. 15	3793
Niantic Bouquet Shop	Niantic	1	Sept. 21	3830
North Avenue Nursery	Bridgeport	1	Sept. 4	3736
North-Eastern Forestry Co.	Cheshire	96	Aug. 17	3672
North Greenwich Nursery	Greenwich	1	Sept. 15	3792
North Street Gardens	Milford	1	Nov. 5	3948
Northville Gardens	New Milford	1	Sept. 18	3813
Nyveldt's Nursery	New London	2	Aug. 26	3701
Oakland Nurseries	Manchester	40	July 23	3619
Oldfield Nursery	Stratford	1	July 28	3632
Old Mill Brook Nursery, Ye	Hamden	2	Nov. 24	3957
Old Orchard Nursery	Norwalk	2	Sept. 13	3782
Outpost Nurseries, Inc.	Ridgefield	750	Aug. 7	3652

CONNECTICUT NURSERY FIRMS CERTIFIED IN 1937—(Continued)

Name of firm	Address	Acreage	Certificate date	Certificate number
Ouwerkerk, Dirk K.	Yalesville	10	Aug. 23	3688
Over-the-Garden-Wall	West Hartford	3	July 31	3638
Oxoboxo Nursery	Montville	2	Aug. 23	3689
Palmieri Florist & Nursery	New Haven	1	Sept. 8	3752
Park Place Nurseries	Marion	2	Oct. 26	3937
Partrick Nursery	Sandy Hook	1	Sept. 11	3778
Paton, William D.	Mount Carmel	1	Oct. 11	3912
Pendleton's Flower Gardens	Norwich	2	Aug. 11	3661
Peschko, Robert	Danbury	1	Aug. 31	3719
Pestretto, Frank	West Hartford	1	Sept. 9	3764
Pestretto, Salvatore	Hartford	1	Sept. 8	3753
Peterson's Flower Shop & Nursery	West Hartford	1	Sept. 24	3852
Pflomm, Charles W.	Bridgeport	1	Sept. 4	3739
Pierson, Inc., A. N.	Cromwell	350	Aug. 13	3668
Pinchbeck Bros., Inc.	Ridgefield	10	Aug. 9	3654
Pine Hirst Gardens	Guilford	1	Aug. 28	3710
Pine Plains Greenhouse, Inc.	Norwich	2	Aug. 26	3696
Polish Orphanage Farm	New Britain	1	Sept. 21	3826
Pomeroy Blue Spruce Gardens	New Milford	2	Sept. 18	3814
Prospect Nurseries, Inc.	Cromwell	25	Aug. 11	3665
Q Garden Farm	Milford	1	Dec. 11	3969
Quinebaug Forestry Co.	Stafford Springs	3	Oct. 13	3916
Rabinak Flower Farm	Deep River	3	Sept. 4	3734
Race Brook Gardens	Orange	1	Sept. 28	3866
Reliable Nursery, The	East Hartford	2	Sept. 10	3765
Rengerman's Garden	Granby	1	Oct. 5	3890
Reveley, F. J.	Clinton	2	Sept. 7	3746
Reynolds' Farms	South Norwalk	1	July 16	3610
Richmond, Gordon L.	New Milford	15	Sept. 22	3837
Ridgewood Nurseries	Milford	1	Oct. 19	3932
Robinson Estate, S. N.	West Hartford	2	Sept. 2	3724
Rockfall Nursery & Tree Expert Co., Ye Olde	Rockfall	45	Oct. 19	3933
Rockfall Nursery Co.	Rockfall	4	Sept. 28	3863
Rolf, Mrs. Fred H.	Guilford	1	Dec. 23	3976
Rose Hill Nursery	Gildersleeve	3	Sept. 13	3804
Runacres Gardens	Madison	3	Sept. 17	3802
Russell St. Perennial Garden	South Manchester	1	July 20	3613
Sage Brothers	North Woodbury	1	Sept. 11	3772
Sakson's Nursery	Greenwich	1	Aug. 30	3714
Sandelli Greenhouses	New Britain	1	Dec. 13	3971
Sasco Hill Nursery	Southport	1	Oct. 13	3914
Savanella Bros. (2)	Torrington	2	Oct. 2	3881
Scarano Nursery, Alphonse	Groton	1	Sept. 8	3754
Schaeffer, Peter	Norwich	3	Aug. 23	3690
Schaghticoke Farm Nursery	Bridgewater	11	Oct. 1	3873
Schleichert Nursery	Bridgeport	4	Dec. 23	3975
Schmidt, Walter A.	West Hartford	2	Oct. 8	3902
Schneider, Adolf	Milford	1	Oct. 29	3938
Schuller, John	Higganum	2	Sept. 2	3726
Schulze, Charles T.	Bethel	1	Nov. 30	3959
Schulze, Edward E.	Bethel	1	Sept. 16	3795
Scott's Nurseries	Bloomfield	10	Sept. 7	3747
Scotty's Landscape Service	Woodbury	1	Sept. 17	3809
Sears, Roebuck & Co.	Manchester	10	July 23	3620
Seltsam's Pequonnock Gardens	Bridgeport	1	Oct. 15	3924
Seymour Gardens, Prudence	New Milford	1	Sept. 18	3816
Seymour's Hemlock Nursery	Riverton	1	Sept. 18	3817

CONNECTICUT NURSERY FIRMS CERTIFIED IN 1937—(Continued)

Name of firm	Address	Acreage	Certificate date	Certificate number
Sharon Valley Nursery	Sharon	1	July 23	3617
Silver City Nursery	Meriden	5	Sept. 10	3769
Silvermine Nurseries	Norwalk	1	Dec. 10	3968
Simonsen, H. C.	Plainville	3	Sept. 21	3825
Sipocz Arrowhead Farm	Fairfield	1	July 27	3623
Smith & Son, Edward A.	Mystic	1	Sept. 9	3762
Soltes Nursery, M. J.	Shelton	2	Oct. 11	3910
Southington Nursery	Southington	15	Aug. 9	3655
Southport Nursery	Southport	35	Aug. 4	3648
South Wilton Nurseries	Wilton	7	July 20	3612
Springdale Florist, The	Springdale	1	Sept. 30	3870
Spring Nurseries	Forestville	1	Aug. 10	3657
Stack, Garrett M.	Guilford	1	Aug. 28	3709
Stafford Conservatories	Stafford Springs	1	Aug. 4	3649
Standish, Norman S. (2)	Hanover	1	Sept. 22	3831
Stannard, Julia	Wilton	1	Sept. 25	3858
State Street Nursery	Hamden	2	Sept. 7	3743
Steck Nursery	Bethel	4	Nov. 18	3954
Steck & Sons, Charles A.	Newtown	20	Oct. 15	3923
Steele's Nurseries, Charles	Greenwich	2	Aug. 31	3716
Stocking, Milton C.	Simsbury	1	Nov. 9	3949
Strayer, Paul	Stratford	1	July 26	3621
Sunridge Nurseries	Greenwich	75	Sept. 24	3851
Sunrise Nursery	North Haven	1	Oct. 2	3879
Sunny Ridge Nursery	Bethel	1	Sept. 13	3780
Swendson, Hans	Cheshire	1	Oct. 11	3911
Sylvan Greenhouse & Nursery	Bridgeport	2	Aug. 16	3671
Taylor, Walter G. (2)	Wallingford	1	Sept. 21	3829
Thomson Co., W. W.	West Hartford	4	Oct. 8	3898
Tierney, Wm. L.	Greenwich	2	Apr. 22*	3600
Torizzo, P. A.	West Hartford	5	Sept. 9	3756
Tower Crispette Co.	Guilford	1	Aug. 28	3711
Tow Path Gardens, Inc.	Hartford	15	Nov. 23	3955
Tracy, B. Hammond	Yalesville	1	Oct. 1	3875
Triangle Nursery	Yalesville	2	Sept. 30	3869
Twin Pines Garden	New Milford	1	Sept. 18	3818
Uplands Flower Gardens	Woodbury	1	Sept. 11	3773
Valley View Nursery	Southington	1	Oct. 30	3940
Van der Bom, F.	Bethel	6	Sept. 7	3740
Vanderbrook & Son, C. L.	Manchester	54	July 30	3636
Van Wilgen Nurseries	Branford	20	Sept. 14	3784
Van Wilgen, William	Branford	1	Sept. 15	3789
Vasileff Nurseries	Greenwich	4	Aug. 31	3717
Verkades Nurseries	New London	60	Sept. 7	3750
Vernick, John H.	Bridgeport	2	Oct. 7	3897
Wallace Nursery	Wallingford	5	Aug. 19	3677
Wallingford Nurseries of the Barnes Nursery & Orchard Co.	Wallingford	60	Oct. 11	3909
Ward & Son, John F.	Windsor	1	Sept. 14	3785
Watertown Nurseries	Watertown	1	Sept. 27	3861
Weinberger, William	Ridgefield	2	Aug. 3	3645
Westerly Nurseries	Pawcatuck	2	Nov. 4	3947
West Mystic Gardens	West Mystic	1	Sept. 11	3779
Westover Trading Corporation	Stamford	1	Sept. 23	3844
West Street Nursery Co.	Danbury	1	Sept. 11	3775
Westville Nurseries	New Haven	3	Dec. 16	3973

* Certificate expired August 1, 1937.

CONNECTICUT NURSERY FIRMS CERTIFIED IN 1937—(Concluded)

Name of firm	Address	Acreage	Certificate date	Certificate number
Wethersfield Nursery	Wethersfield	3	Sept. 17	3808
Wheeler, Charles B.	Stonington	1	Sept. 9	3763
Whittemore Co., J. H.	Naugatuck	3	Sept. 21	3823
Wild Flower Nursery	Brookfield	1	Sept. 17	3815
Wild's Nursery, Henry	Norwalk	30	Aug. 27	3704
Willow Gardens	Darien	1	Sept. 25	3857
Wilridge Nurseries	Ridgefield	5	Aug. 14	3669
Wilson Landscape Co., The	Hartford	1	Sept. 14	3787
Wilson, M. L.	Litchfield	5	Aug. 10	3658
Wilson & Co., Inc., C. E.	Manchester	125	Aug. 3	3643
Woodbridge Nurseries	New Haven	4	Nov. 1	3943
Woodcrythe Nursery (E.H. & W.S. Sloan)	New Canaan	1	July 9	3609
Woodmont Nurseries	Woodmont	80	Sept. 20	3820
Wyllie, David	North Haven	1	Oct. 8	3900
Yale University Forest School Nursery	New Haven	1	Aug. 27	3703
Yale University Landscape Department	New Haven	10	Sept. 8	3755
Young's Nurseries	Wilton	2	Aug. 19	3676
Zack Co., H. J.	Deep River	10	Sept. 17	3806
Total	**377 nurseries**	**5,001 acres**		

The following nursery firms failed to qualify before the end of December and did not receive certificates in 1937 after the summer inspection.

Name	Address
Clyne Nurseries (George A. Clyne, Propr., Middlebury)	RFD, Waterbury
Ellington Evergreen Nursery (S. Lavitt, Propr.)	Ellington
S. Miliano	Woodmont
John Stalzer & Son	Brooklyn
Wm. L. Tierney	Greenwich

One nurseryman was convicted for selling nursery stock without holding a valid certificate of inspection.

The cost of inspecting these nurseries in 1937, including certain additional visits to make sure that pests had been eradicated, was approximately $1,837.73.

Other Kinds of Certificates Issued

During 1937, 136 duplicate certificates were issued to Connecticut nurserymen, to be filed in other states. Altogether, 101 dealer's permits were issued to registered dealers who do not grow the nursery stock that they sell. Shipper's permits to the number of 224 were issued to nurserymen in other states who wish to ship stock into Connecticut. Also, 627 parcels of nursery stock were inspected and certified for shipment to accommodate individuals.

There were also issued 142 miscellaneous certificates and special permits, 180 blister rust control area permits, 1,307 corn borer certificates and 844 certificates for packages of shelled corn and other seeds, many of which were consigned to foreign countries.

Inspection of Imported Nursery Stock

The quantity of nursery stock entering Connecticut from foreign countries in 1936-1937 was slightly greater than in the preceding year. Both the number of shipments and number of plants were slightly larger, although the number of cases was smaller. This stock enters the United States under regulations and permits issued by the Federal Bureau of Entomology and Plant Quarantine, and at ports of entry was released for transit to destination points, where it was examined by state inspectors.

In 1936-1937, there were 14 shipments, containing 67 cases, and 542,975 *Rosa manetti* plants, all of which were stocks for propagation, and all were inspected by Mr. Zappe. This stock was imported by three commercial rose growers, who received 442,975, 90,000 and 10,000 plants respectively. This stock came from the following sources:

Country	No. shipments	No. plants
Holland	12	512,975
England	2	30,000
	14	542,975

The time required to inspect this rose stock was equivalent to 13 days of work for one man, and together with the cost of travel (1,102 miles) and other necessary expenses, made a total cost of approximately $187.00. Reports of the 14 shipments were sent to the Federal Bureau of Entomology and Plant Quarantine.

Results of Inspection

Of the 14 shipments inspected, 4 shipments, or 30 percent, were found infested with insects—a sawfly, *Emphytus cinctus* Linn.

In addition to the rose stocks mentioned above, the following plants and seeds entered Connecticut: 200 Kentia palm seeds, 100 Cocos palm seeds, 313 pounds of tree and shrub seeds, 9,920 pounds of onion sets, 143 fruit tree seedlings, 150 clematis plants, 85 iris root stocks, 74 dahlia tubers, 240 corydalis roots, 3 Sanguinaria roots and 1 columbine root. These were not inspected in Connecticut but were examined and released by Federal inspectors at ports of entry.

INSPECTION OF APIARIES, 1937

W. E. Britton

In 1937, two inspectors covered the State, as has been the custom in preceding years. Mr. H. W. Coley of Westport made the inspections in the four southern counties of Fairfield, New Haven, Middlesex and New London, and Mr. W. H. Kelsey of Bristol inspected the apiaries in the four northern counties of Litchfield, Hartford, Tolland and Windham. These inspections can best be made on warm sunny days when the bees are flying and gathering honey, so the work began in May and ended in October. Somewhat more American foul brood was found than in 1936, or in any preceding year, although the percentage is smaller than in certain seasons. Fairfield, Litchfield and Hartford counties contained a larger percentage of apiaries infested with American foul brood than the other counties, but apiaries infested with this disease were found in each county in the State.

Altogether, 1,437 apiaries containing 10,253 colonies were inspected in 1937. These averaged 7.1 colonies per apiary as against 6.45 in 1936. There were 222 colonies in 107 apiaries infested with American foul brood, and 60 of these apiaries were inspected twice, and two, three times.

The total cost of this inspection in 1937 was $1,848.22, of which $690.14 was from the balance of the appropriation for the fiscal year ending June 30, 1937, and $1,158.08 from the appropriation of $2,110.00 for the present fiscal year, available July 1, 1937.

Table 2. Twenty-Eight Year Record of Apiary Inspection in Connecticut

Year	Number apiaries	Number 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
1930	1,059	10,335	9.76	2.01	.206
1931	1,232	10,678	8.66	1.83	.212
1932	1,397	11,459	8.2	1.60	.195
1933	1,342	10,927	8.1	1.69	.208
1934	1,429	7,128	4.98	1.40	.28
1935	1,333	8,855	6.64	1.556	.234
1936	1,438	9,278	6.45	1.429	.221
1937	1,437	10,253	7.1	1.28	.18

Table 2 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 inspection began in 1910.

In 1937, apiaries were inspected in 149 towns. Inspections were made in the following eight towns not visited in 1936:

New Haven County: Madison; *Tolland County*: Somers, Stafford, Union, Willington; *Windham County*: Brooklyn, Chaplin, Hampton.

On the other hand, in the following 18 towns visited in 1936, no inspections were made in 1937:

Fairfield County: Brookfield, Fairfield, Redding, Weston; *New Haven County*: Ansonia, Beacon Falls, Branford, Cheshire, Derby, Milford; *Middlesex County*: Cromwell, Killingworth; *Windham County*: Eastford, Killingly, Pomfret, Putnam, Thompson, Woodstock.

There were four apiaries infested with sacbrood and 107 apiaries infested with American foul brood.

In 1937, American foul brood was discovered in the following 58 towns:

Fairfield County: Danbury, Darien, Greenwich, New Canaan, Norwalk, Stamford, Stratford, Trumbull, Wilton; *New Haven County*: Hamden, Meriden, Middlebury, Naugatuck, North Haven, Wallingford, Woodbridge; *Middlesex County*: Clinton, Durham; *New London County*: Ledyard, Montville, Preston; *Litchfield County*: Bethlehem, Litchfield, New Hartford, New Milford, North Canaan, Plymouth, Salisbury, Sharon, Thomaston, Warren, Washington, Winchester, Woodbury; *Hartford County*: Berlin, Bloomfield, Bristol, Burlington, Canton, East Hartford, Farmington, Granby, Hartford, New Britain, Newington, Plainville, Southington, Suffield, West Hartford, Windsor; *Tolland County*: Coventry, Hebron, Mansfield, Stafford, Vernon; *Windham County*: Plainfield, Scotland, Windham.

Statistics of Inspection

The statistics of apiary inspection by towns and counties are shown on the following pages, with summary on page 169.

Inspection of Apiaries, 1937

Town	Apiaries Inspected	Apiaries Diseased (Am. f. b.)	Colonies Inspected	Colonies Diseased (Am. f. b.)
Fairfield County				
Bethel	6	—	16	—
Bridgeport	1	—	28	—
Danbury	5	1	52	3
Darien[1]	4	3	57	6
Easton	5	—	29	—
Greenwich	5	1	68	18
Monroe	8	—	58	—
New Canaan	6	1	64	1
New Fairfield	15	—	110	—
Newtown	5	—	56	—
Norwalk	4	1	19	1
Ridgefield	6	—	36	—

[1]One apiary inspected twice.

Town	Apiaries Inspected	Apiaries Diseased (Am. f. b.)	Colonies Inspected	Colonies Diseased (Am. f. b.)
Fairfield County—(Continued)				
Shelton	2	—	52	—
Sherman	4	—	21	—
Stamford[2]	13	6	69	13
Stratford	3	1	53	1
Trumbull	14	2	93	4
Westport	6	—	131	—
Wilton	8	1	60	1
	120	17	1,072	48
New Haven County				
East Haven	1	—	7	—
Guilford	4	—	72	—
Hamden	16	3	66	5
Madison	1	—	6	—
Meriden	22	1	201	2
Middlebury	5	1	59	1
Naugatuck	4	1	35	2
New Haven	1	—	4	—
North Branford	2	—	39	—
North Haven	3	1	4	2
Orange	3	—	22	—
Oxford	6	—	67	—
Prospect	2	—	10	—
Seymour	4	—	15	—
Southbury	4	—	142	—
Wallingford[1]	6	1	172	3
Waterbury	2	—	5	—
Wolcott	2	—	11	—
Woodbridge	5	1	29	1
	93	9	966	16
Middlesex County				
Chester	6	—	42	—
Clinton	5	1	40	7
Durham	9	1	111	1
East Haddam	7	—	74	—
East Hampton	14	—	93	—
Essex	9	—	52	—
Haddam	8	—	54	—
Middlefield	4	—	99	—
Middletown	15	—	155	—
Old Saybrook	4	—	22	—
Portland	5	—	68	—
Saybrook[1]	6	—	29	—
Westbrook	3	—	44	—
	95	2	883	8
New London County				
Bozrah	2	—	64	—
Colchester	19	—	193	—
East Lyme	8	—	73	—
Franklin	4	—	44	—
Griswold	5	—	67	—

[1]One apiary inspected twice.

[2]One colony with sacbrood.

Town	Apiaries Inspected	Apiaries Diseased (Am. f. b.)	Colonies Inspected	Colonies Diseased (Am. f. b.)
New London County—(Continued)				
Groton	11	—	80	—
Lebanon[1]	9	—	190	—
Ledyard[1]	8	3	84	11
Lisbon	1	—	16	—
Lyme	4	—	94	—
Montville	4	1	24	2
New London	2	—	18	—
North Stonington	2	—	17	—
Norwich	8	—	269	—
Old Lyme[1]	5	—	19	—
Preston	8	1	62	8
Salem	2	—	23	—
Sprague	3	—	42	—
Stonington	9	—	58	—
Voluntown	3	—	18	—
Waterford	10	—	74	—
	127	5	1,529	21
Litchfield County				
Barkhamsted	7	—	21	—
Bethlehem[3]	16	3	137	4
Bridgewater	7	—	63	—
Canaan	1	—	8	—
Colebrook[3]	6	—	132	—
Cornwall	7	—	32	—
Goshen	9	—	42	—
Harwinton	9	—	43	—
Kent	10	—	92	—
Litchfield[3]	23	3	122	4
Morris	6	—	20	—
New Hartford[3]	18	2	82	2
New Milford[4]	29	3	170	6
Norfolk	5	—	17	—
North Canaan[3]	7	1	82	1
Plymouth[4]	16	3	95	5
Roxbury	7	—	29	—
Salisbury[2]	13	1	55	1
Sharon[3]	19	2	262	7
Thomaston	6	1	49	1
Torrington	26	—	78	—
Warren[4]	11	2	59	2
Washington[3]	15	1	57	2
Watertown	19	—	138	—
Winchester	11	1	51	2
Woodbury[4]	16	3	93	3
	319	26	2,029	40
Hartford County				
Avon	10	—	24	—
Berlin[5]	27	2	221	3
Bloomfield	19	1	148	3

[1] One apiary inspected twice
[2] Two colonies with sacbrood.
[3] One apiary inspected twice.
[4] Three apiaries inspected twice.
[5] Four apiaries inspected twice.

Town	Apiaries Inspected	Apiaries Diseased (Am. f. b.)	Colonies Inspected	Colonies Diseased (Am. f. b.)
Hartford County—(Continued)				
Bristol[2]	21	4	119	8
Burlington[3]	9	1	55	2
Canton[1]	11	2	66	2
East Granby	12	—	44	—
East Hartford[1]	18	3	111	12
East Windsor	11	—	73	—
Enfield	9	—	62	—
Farmington[1]	16	2	63	2
Glastonbury	33	—	127	—
Granby[2]	19	1	83	1
Hartford	10	1	74	1
Hartland	4	—	29	—
Manchester	11	—	60	—
Marlborough	5	—	48	—
New Britain[3,4]	35	2	195	6
Newington[5,6]	23	6	79	9
Plainville	8	1	31	1
Rocky Hill	7	—	29	—
Simsbury	16	—	67	—
Southington[4]	31	4	253	6
South Windsor[1]	18	—	114	—
Suffield[7]	23	2	108	3
West Hartford	21	1	110	3
Wethersfield	15	—	62	—
Windsor[1]	19	3	140	5
Windsor Locks	6	—	45	—
	467	36	2,640	67
Tolland County				
Andover	3	—	4	—
Bolton	2	—	9	—
Columbia	10	—	91	—
Coventry	22	2	117	3
Ellington	2	—	2	—
Hebron[1]	12	1	74	1
Mansfield[7]	18	3	83	7
Somers	9	—	41	—
Stafford[1]	12	1	38	2
Tolland	11	—	42	—
Union	1	—	2	—
Vernon	12	1	81	2
Willington	17	—	39	—
	131	8	623	15
Windham County				
Ashford	14	—	55	—
Brooklyn	8	—	117	—
Canterbury	4	—	40	—
Chaplin	4	—	11	—
Hampton	11	—	40	—

[1]One apiary inspected twice.
[2]Three apiaries inspected twice.
[3]One colony with sacbrood.
[4]Five apiaries inspected twice.
[5]Two apiaries inspected three times.
[6]Four apiaries inspected twice.
[7]Two apiaries inspected twice.

Town	Apiaries Inspected	Apiaries Diseased (Am. f. b.)	Colonies Inspected	Colonies Diseased (Am. f. b.)
Windham County—(Continued)				
Plainfield	13	1	111	1
Scotland	13	1	74	2
Sterling	3	—	9	—
Windham	15	2	54	4
	85	4	511	7

SUMMARY

County	Number towns	Apiaries Inspected	Apiaries Diseased (Am. f. b.)	Colonies Inspected	Colonies Diseased (Am. f. b.)
Fairfield[1,2]	19	120	17	1,072	48
New Haven[1]	19	93	9	966	16
Middlesex[1]	13	95	2	883	8
New London[1]	21	127	5	1,529	21
Litchfield[1,2]	26	319	26	2,029	40
Hartford[1,2,3]	29	467	36	2,640	67
Tolland[1]	13	131	8	623	15
Windham	9	85	4	511	7
	149	1,437	107	10,253	222

	Apiaries	Colonies
Inspected, 1937	1,437	10,253
Infested with American foul brood	107	222
Percentage infested	7.4	2.1
Colonies treated		37
Colonies destroyed		185
Average number of colonies per apiary		7.1
Average cost of inspection	1.28	.18
Total cost of inspection for 1937	$1,848.22	

[1]Fairfield County, one apiary inspected twice; New Haven County, one apiary inspected twice; Middlesex County, one apiary inspected twice; New London County, three apiaries inspected twice; Litchfield County, nineteen apiaries inspected twice; Hartford County, thirty-one apiaries inspected twice; Tolland County, four apiaries inspected twice.

[2]Fairfield County, one colony with sacbrood; Litchfield County, two colonies with sacbrood; Hartford County, two colonies with sacbrood.

[3]Hartford County, two apiaries inspected three times.

Financial Statement

January 1, 1937—June 30, 1937

Appropriation for year July 1, 1936 to June 30, 1937		$1,999.00
RECEIPTS		
Balance on hand January 1, 1937		$690.64
DISBURSEMENTS		
Salaries	$357.75	
Travel (outlying investigations)	332.39	
Total Disbursements		$690.14
Balance on hand July 1, 1937		$ .50*

July 1, 1937—December 31, 1937

RECEIPTS		
Appropriation year ending June 30, 1938		$2,110.00
DISBURSEMENTS		
Salaries	$578.25	
Travel (outlying investigations)	579.83	
Total Disbursements		$1,158.08
Balance on hand January 1, 1938		$951.92
Total disbursements for 1937		$1,848.22

*Reverts to State Treasury.

Registration of Bees

Section 2129 of the General Statutes provides that each beekeeper shall register his bees on or before October 1 of each year with the town clerk of the town in which the bees are kept, and that each town clerk, on or before December 1, shall report to the State Entomologist whether or not any bees have been registered, and if so, shall send a list of the names and number of colonies belonging to each. In 1937, 1,437 apiaries containing 10,253 colonies were inspected. There were registered 924 apiaries and 5,485 colonies in 1937, and after checking the registrations and inspections, and deducting the duplications, the following figures show that at least this number of apiaries and colonies were kept in Connecticut in 1937:

	Apiaries	Colonies
Inspected	1,437	10,253
Registered but not inspected	476	2,142
Total	1,913	12,395

REPORT ON CONTROL OF THE GYPSY MOTH, 1937

W. E. Britton, J. T. Ashworth and O. B. Cooke

During the 1936-1937 scouting season, gypsy moth control work has been carried on by the regular state force, under the immediate charge of Mr. J. T. Ashworth, in much the same manner as it has been for several years, in coöperation with the Federal Bureau of Entomology and Plant Quarantine. The Federal Bureau performed control work in that section west of the Connecticut River, in what is known as the "Barrier Zone," an area established for the purpose of preventing the westward spread of the gypsy moth. In most of the towns between the eastern edge of the Barrier Zone and the Connecticut River, extensive gypsy moth control work was carried on by CCC camp crews located in that vicinity. The activities of the regular state organization of men were confined to Windham, New London, Tolland, and Hartford counties, most of the work being carried on east of the Connecticut River.

For the satisfactory coöperation always received, the writers here express their gratitude and thanks to the following persons: Mr. A. F. Burgess, who has general supervision of Gypsy and Brown-tail Moth Control for the Bureau of Entomology and Plant Quarantine; Mr. H. L. Blaisdell, in charge of field work, under Mr. Burgess; Mr. S. S. Crossman, under whose direction gypsy moth control work was carried on in the various CCC camps in the central part of Connecticut; and to Mr. A. F. Hawes, State Forester, who has general supervision of the CCC camps.

New Equipment

Before the spraying season began, 2,000 feet of spray hose were purchased to replace a like amount that had become worn out. The 1933 Chevrolet sedan used on this work had been driven approximately 76,000 miles, at which point it was considered advisable to turn it in rather than make further repairs. This was done in May, 1937, and a 1937 Ford Fordor sedan, Model 74, was purchased.

Sundry small wrenches and other tools were purchased during the year to replace others that were worn out.

Control Operations

Following is a brief report of gypsy moth control operations for the year, by the different agencies.

Work Performed by State Men

The regular state gypsy moth crews operated in Hartford, New London, Tolland and Windham counties.

Hartford County: Scouting work was performed in the towns of East Hartford, East Windsor, Enfield, Glastonbury and South Windsor, gypsy moth infestations being found in all the towns visited except in East Windsor and South Windsor. During the larval season, the towns of Bloomfield, East Granby, Enfield, Glastonbury, Granby, Hartford, Simsbury, Suffield, West Hartford, and Windsor were visited, caterpillars being found in all these towns, except in Glastonbury and Hartford. In June, spraying was done in Enfield and Glastonbury.

New London County: During the season, scouting work was performed in the following towns: Franklin, Groton, Montville, New London, North Stonington, Norwich, Preston, Salem, Stonington, and Waterford, gypsy moth infestations being found present in all of these towns, except in Franklin and Waterford. During the larval season the towns of East Lyme, Groton, Lebanon, Montville, New London, Norwich, Preston, and Stonington were visited, caterpillars being found at all points visited. During June, infestations were sprayed in Colchester, Montville, New London, Norwich and Salem.

Tolland County: Scouting work was performed during the year in the following towns: Andover, Bolton, Coventry, Hebron, Somers, Stafford, and Vernon, gypsy moth infestations being found in all of these towns. During the larval season, visits were made to the towns of Andover Bolton, Columbia, Coventry, Hebron, Mansfield, Somers, and Stafford; caterpillars were found in all of these towns. In June, spraying was done in the towns of Bolton, Coventry, Somers, and Vernon.

Windham County: In the performance of gypsy moth control work during the past season state employees did scouting work and found heavy infestations in the towns of Brooklyn, Killingly, Plainfield and Putnam. The town of Brooklyn was visited during the larval season, caterpillars being present at all points visited. No spraying was done in Windham County this year.

State men, during the past season, scouted 342 miles of roadside and 2,957 acres of woodland, destroyed 38,621 egg-clusters and 68,121 larvae and pupae, applied 68,157 bands to trees in and around known infested areas, and 7,094 pounds of arsenate of lead were used in the spraying operations.

Work Performed by CCC Men

During the course of the 1936-37 scouting season, details of men from the various CCC camps, located in the central and eastern parts of the State, were engaged in control work in the form of scouting, banding, and patrolling for larvae. Working in 46 towns in Hartford, Litchfield, Middlesex, New Haven, New London, Tolland and Windham counties, they were responsible for the destruction of 268,508 egg-clusters and 1,031,606 larvae and pupae. During the year they scouted 1,154 miles of roadside and 372,181 acres of open and wooded country, and applied 529,301 bands to trees in and around infested areas. The work performed by CCC men from camps in eastern Connecticut, established in the towns of Hampton, Voluntown and Colchester, was under the supervision of men from the regular state gypsy moth force.

WPA Work Performed

With funds made available by the Works Progress Administration, a Gypsy Moth Control Project, administered from the Greenfield office of the Bureau of Entomology and Plant Quarantine, was carried on in all counties of the State, except Windham County, during the year. As heretofore, most of the labor for this project was taken from the relief rolls of

the towns in the vicinity where the work was carried on. Control work in the form of scouting, banding and spraying was carried on in 49 towns in Fairfield, Hartford, Litchfield, Middlesex, New Haven, New London, and Tolland counties. During the scouting season, these WPA workers inspected 1,998 miles of roadside, 320,424 acres of open and wooded country and destroyed 70,800 egg-clusters and 89,431 larvae and pupae. Just prior to the larval season, they applied 49,011 burlap bands to the trees in and around known infested areas. In June, they used 76,108 pounds of arsenate of lead during the spraying operations.

Resettlement Administration Project

From October, 1936, to July, 1937, gypsy moth control work in the form of scouting, banding and patrolling for larvae, was carried on by the Resettlement Administration on their own properties in the towns of Griswold and Sterling. The scouting crew inspected 3,210 acres of woodland and destroyed 8,473 egg-clusters. During the larval season 1,950 bands were applied to trees at the infestation in Griswold, and the daily patrolling of these bands accounted for the destruction of 2,911 larvae and pupae. Mr. Ashworth supervised this work.

Scouting for Brown-Tail Moth

On March 1, 1937, a Brown-tail Moth Scouting Project, with funds furnished by the Works Progress Administration, was again started in eastern Connecticut. This project was carried on under the supervision of Dr. J. N. Summers, of the Bureau of Entomology and Plant Quarantine office, at Greenfield, Mass. A re-check of the towns scouted last year was carried on and some additional towns were scouted that were not visited last year. In all, 2,763 miles of roadside and surrounding territory were scouted in 37 towns in the eastern part of the State. During the life of this project, scouting was carried on in the following towns: Ashford, Brooklyn, Canterbury, Chaplin, Eastford, East Windsor, Ellington, Enfield, Griswold, Groton, Hampton, Killingly, Ledyard, Lisbon, Mansfield, Montville, New London, North Stonington, Norwich, Plainfield, Pomfret, Preston, Putnam, Scotland, Somers, Sprague, Stafford, Sterling, Stonington, Thompson, Tolland, Union, Voluntown, Waterford, Willington, Windham, and Woodstock. This work was given local supervision by Mr. J. T. Ashworth and other members of the regular state gypsy moth force. No brown-tail moth infestations were found in Connecticut during this scouting season.

Quarantines

There were no quarantine changes during the year that affect the regulated areas in Connecticut.

The following pages show the statistics of gypsy moth suppression operations of all these agencies, with summary on page 178.

STATISTICS OF INFESTATIONS, 1936-1937

Towns	Infestations found	Egg-clusters creosoted	Number colonies sprayed	Lbs. lead used	Larvae, pupae crushed	Bands applied	Miles scouted	Acres scouted	Acres cleaned
Windham County									
Brooklyn[1]	1	741	0	0	761	0	0	16	0
Eastford[3]	2	6,807	0	0	14,762	319	16	1,847	0
Killingly[1]	8	21,148	0	0	0	0	2	686	0
Plainfield[1]	2	69	0	0	0	0	1	0	0
Pomfret[3]	1	2,257	0	0	40,401	181	0	44	12
Putnam[1]	1	865	0	0	0	0	1	7	0
Sterling[8]	38	6,492	0	0	64,833	1,060	0	10,748	0
Woodstock[3]	3	150,285	0	0	682,583	7,598	10	3,741	14
	56	188,664	0	0	803,340	9,158	30	17,089	26
New London County									
Colchester[5]	12	21,805	1	64	17	205	0	2,985	2
East Lyme[4]	1	28	0	0	5	134	7	1,840	0
Franklin[1]	0	0	0	0	0	0	2	19	0
Griswold[7]	7	7,567	0	0	2,911	1,950	0	1,710	0
Groton[4]	13	2,569	0	0	8,844	930	16	1,475	1
Lebanon[4]	0	0	0	0	5,675	2,114	0	0	0
Montville[1]	11	1,398	3	1,616	25	296	104	244	0
New London[4]	3	8,007	2	2,132	1,503	1,110	14	2,163	1
North Stonington[1]	7	2,359	0	0	0	0	0	102	0
Norwich[1]	2	31	1	64	53	143	1	0	1
Preston[1]	*	6	0	0	6	0	1	0	1
Salem[1]	1	18	1	48	0	0	0	17	0
Stonington[4]	6	6,370	0	0	23,414	395	14	5,136	9
Voluntown[3]	10	1,541	0	0	1,214	372	0	4,814	0
Waterford[1]	0	0	0	0	0	0	1	0	0
	73	51,699	8	3,924	43,667	7,649	160	20,505	15

Footnotes after summary.
*Six single egg-clusters found in widely scattered places, not sufficient enough to be considered as infestations.

STATISTICS OF INFESTATIONS, 1936-1937—*Continued*

Towns	Infestations found	Egg-clusters creosoted	Number colonies sprayed	Lbs. lead used	Larvae, pupae crushed	Bands applied	Miles scouted	Acres scouted	Acres cleaned
Tolland County									
Andover[1]	8	553	0	0	288	260	15	254	0
Bolton[1]	4	40	1	288	201	85	3	58	0
Columbia[4]	2	32,923	0	0	24,812	1,947	3	1,112	7
Coventry[1]	31	1,747	6	2,130	1,061	1,121	11	508	0
Ellington[3]	15	31	0	0	697	156	0	9	9
Hebron[1]	10	2,599	0	0	5,179	710	16	144	2
Mansfield[4]	7	5,716	0	0	6,384	408	10	1,915	3
Somers[5]	35	423	1	448	1,639	985	42	171	9
Stafford[4]	16	12,173	0	0	41,110	3,720	51	4,923	7
Vernon[1]	7	44	1	160	0	38	63	14	0
	135	56,249	9	3,026	81,371	9,430	214	9,108	37
Middlesex County									
Durham[6]	2	34	0	0	2,155	16,763	48	17,864	31
Haddam[3]	2	65	0	0	1,404	27,940	30	13,433	0
Middlefield[6]	3	5	0	0	60	9,878	1	1,000	9
Middletown[6]	7	821	1	10,095	6,043	58,300	92	23,993	304
	14	925	1	10,095	9,662	112,881	171	56,290	344
Hartford County									
Berlin[6]	8	93	0	0	1,155	9,344	12	3,695	75
Bloomfield[5]	11	782	0	0	1,434	16,251	60	17,436	0
Bristol[3]	0	0	0	0	0	0	77	17,252	0
Burlington[3]	6	1,109	0	0	14,167	92,620	9	3,255	122
Canton[3]	8	11,409	0	0	34,928	2,043	24	5,683	166
East Granby[5]	8	88	0	0	1,197	4,658	29	11,341	0
East Hartford[1]	1	1	0	0	0	0	11	10	0
East Windsor	0	0	0	0	0	0	14	0	0

STATISTICS OF INFESTATIONS, 1936-1937—*Continued*

Towns	Infestations found	Egg clusters creosoted	Number colonies sprayed	Lbs. lead used	Larvae, pupae crushed	Bands applied	Miles scouted	Acres scouted	Acres cleaned
Hartford County—Continued									
Enfield[9]	6	451	1	48	131	103	17	3,548	4
Farmington[3]	4	530	0	0	3,424	383	5	2,312	20
Glastonbury[1]	2	12	1	96	0	9	9	11	0
Granby[5]	35	23,980	0	0	109,132	10,001	29	14,804	1
Hartford[5]	1	1	0	0	0	0	13	6,585	0
Hartland[3]	15	526	0	0	10,228	49,415	23	8,877	69
New Britain[3]	4	25	0	0	32	1,475	13	2,903	3
Newington[3]	0	0	0	0	0	0	3	1,330	0
Plainville[3]	0	0	0	0	0	0	0	140	0
Simsbury[5]	20	35,017	0	0	26,012	20,173	44	18,909	0
Southington[3]	3	107	0	0	1,403	17,686	11	3,825	0
South Windsor	0	0	0	0	0	0	5	16	0
Suffield[5]	7	219	0	0	9,086	4,160	8	3,400	0
West Hartford[5]	7	707	0	0	1,364	845	35	13,999	0
Wethersfield[3]	2	22	0	0	398	4,268	7	2,240	8
Windsor[5]	7	850	0	0	5,200	6,401	50	19,275	0
	155	75,929	2	144	219,291	239,835	508	160,846	468
New Haven County									
Beacon Falls[2]	0	0	0	0	0	0	20	5,309	0
Bethany[2]	0	0	0	0	0	0	34	6,784	0
Branford[3]	4	2	0	0	1,550	1,755	10	763	0
Cheshire[2]	0	0	0	0	0	0	62	13,466	0
Guilford[3]	1	13	0	0	21	5,946	2	143	22
Hamden[2]	0	0	0	0	0	0	118	12,030	0
Madison[3]	0	0	0	0	0	0	7	3,985	0
Meriden[6]	4	330	1	10,678	2,362	16,921	4	2,525	276
Middlebury[2]	0	0	0	0	0	0	51	6,584	0
Naugatuck[2]	0	0	0	0	0	0	20	1,045	0
Oxford[2]	0	0	0	0	0	0	63	13,180	0
Prospect[2]	0	0	0	0	0	0	40	7,708	0

STATISTICS OF INFESTATIONS, 1936-1937—*Continued*

Towns	Infestations found	Egg-clusters creosoted	Number colonies sprayed	Lbs. lead used	Larvae, pupae crushed	Bands applied	Miles scouted	Acres scouted	Acres cleaned
New Haven County—Continued									
Wallingford[2]	4	28	0	0	1,261	4,518	52	16,619	51
Waterbury[3]	0	0	0	0	0	0	29	2,826	0
Wolcott[6]	9	107	2	4,020	621	36,351	51	14,251	325
Woodbridge[2]	0	0	0	0	0	0	52	12,480	0
	22	480	3	14,698	5,815	65,491	615	119,698	674
Litchfield County									
Barkhamsted[3]	28	2,777	0	0	13,684	85,893	22	8,951	90
Canaan[2]	11	4,694	4	22,413	12,554	24,167	30	12,106	112
Colebrook[3]	7	8	0	0	76	17,988	34	8,951	0
Cornwall[2]	5	2,920	3	12,268	0	2,600	77	21,967	62
Harwinton[3]	4	575	0	0	272	8,669	72	21,730	12
Kent[2]	1	17	1	3,734	0	0	0	242	12
Litchfield[2]	3	355	1	2,700	100	0	13	4,189	72
New Hartford[3]	3	58	0	0	1,614	36,465	2	1,209	66
Norfolk[2]	2	65	0	0	64	10,863	4	2,166	28
North Canaan[2]	2	18	0	0	90	2,072	5	1,399	24
Plymouth[3]	0	0	0	0	0	0	92	13,846	0
Salisbury[2]	6	160	0	0	303	3,756	90	27,759	20
Thomaston[3]	0	0	0	0	0	0	55	8,606	0
Torrington[3]	1	6	0	0	15	0	85	23,971	1
Warren[2]	5	798	4	10,200	123	1,035	14	4,229	284
Winchester[3]	3	5	0	0	26	10,467	69	22,731	1
	81	12,456	13	51,315	28,921	203,975	664	184,052	784
Fairfield County									
Bethel[2]	0	0	0	0	0	0	12	1,266	0
Bridgeport[2]	0	0	0	0	0	0	255	5,995	0
Danbury[2]	0	0	0	0	0	0	70	7,460	0
Darien[3]	0	0	0	0	0	0	28	2,454	0

STATISTICS OF INFESTATIONS, 1936-1937—*Continued*

Towns	Infestations found	Egg-clusters creosoted	Number colonies sprayed	Lbs. lead used	Larvae, pupae crushed	Bands applied	Miles scouted	Acres scouted	Acres cleaned
Fairfield County—Continued									
Easton[2]	0	0	0	0	0	0	12	3,598	0
Fairfield[2]	0	0	0	0	0	0	34	582	0
Greenwich[2]	0	0	0	0	0	0	106	9,207	0
New Canaan[2]	0	0	0	0	0	0	49	9,306	0
Newtown[2]	0	0	0	0	0	0	143	24,551	0
Ridgefield[2]	0	0	0	0	0	0	41	7,057	0
Shelton[2]	0	0	0	0	0	0	46	7,463	0
Stamford[2]	0	0	0	0	0	0	162	17,127	0
Stratford[2]	0	0	0	0	2	0	9	290	0
Trumbull[2]	0	0	0	0	0	0	53	9,638	0
Weston[2]	0	0	0	0	0	0	52	12,990	0
Wilton[2]	0	0	0	0	0	0	60	12,200	0
	0	0	0	0	2	0	1,132	131,184	0

SUMMARY OF STATISTICS

Counties	No. of towns	Infestations found	Egg-clusters creosoted	Number colonies sprayed	Lbs. lead used	Larvae, pupae crushed	Bands applied	Miles scouted	Acres scouted	Acres cleaned
Windham	8	56	188,664	0	0	803,340	9,158	30	17,089	26
New London	15	73	51,699	8	3,924	43,667	7,649	160	20,505	15
Tolland	10	135	56,249	9	3,026	81,371	9,430	214	9,108	37
Middlesex	4	14	925	1	10,095	9,662	112,881	171	56,290	344
Hartford	24	155	75,929	2	144	219,291	239,835	508	160,846	468
New Haven	16	22	480	3	14,698	5,815	65,491	615	119,698	674
Litchfield	16	81	12,456	13	51,315	28,921	203,975	664	184,052	784
Fairfield	16	0	0	0	0	2	0	1,132	131,184	0
	109	536	386,402	36	83,202	1,192,069	648,419	3,494	698,772	2,348

[1]State work
[2]WPA work
[3]CCC work
[4]State and WPA work
[5]State and CCC work
[6]WPA and CCC work
[7]Resettlement Administration work
[8]Resettlement Administration and CCC work
[9]State, WPA and CCC work

Financial Statement

July 1, 1936—June 30, 1937

RECEIPTS

Appropriation year ending June 30, 1937	$40,030.00
June 30, 1937, Transferred from State General Fund	2,569.19
Total Receipts	$42,599.19

DISBURSEMENTS

Personal Services:	
Salaries	$15,155.63
Labor	21,179.23
Supplies and Materials:	
Stationery and office supplies	21.04
Insecticides	1,881.00
Lumber and small hardware	1.91
Medical supplies	.50
Other supplies (miscellaneous)	14.09
Communication Service:	
Telephone	51.50
Postage	15.00
Travel Expenses:	
Outlying investigations	186.19
Gasoline	989.43
Transportation of Things:	
Freight, express and parcel post	.44
Heat and Light:	
Fuel	42.88
Electricity	22.00
Contingent Expenses:	
Insurance	513.99
Medical services	4.00
Equipment:	
Tools, machinery and appliances (new)	1,524.89
Tools, machinery and appliances (repairs)	4.75
Automobiles (new)	320.25
Automobiles (repairs)	235.22
Scientific apparatus	21.25
Buildings and Land:	
Rent of storehouse, office space and garages	414.00
Total Disbursements	$42,599.19
Balance on hand, July 1, 1937	.00
	$42,599.19

THE EUROPEAN CORN BORER IN 1937

W. E. Britton, Neely Turner and M. P. Zappe

In 1937, as in the two preceding seasons, sweet corn maturing for harvest in July was heavily infested by the first generation larvae, particularly near the coast in New Haven County and inland along the principal river valleys. In the region around New Haven, the Hartford-Glastonbury-Wethersfield region and in New Milford, early sweet corn was severely damaged by the first generation larvae. Likewise the second generation heavily infested sweet corn maturing in September, in the New Haven region and in the Hartford-Glastonbury-Wethersfield region northward to the Massachusetts line. Seed corn in Milford maturing in September was heavily infested.

According to Dr. C. H. Batchelder*, dahlias were probably more heavily infested generally and more severely damaged by the second generation borers, than ever before in Connecticut. In West Haven a third generation was evidently responsible for a portion of the damage.

Seed beets in Milford were moderately infested. Potatoes were less severely damaged than in 1936.

The activities for control of the European corn borer fall under the following heads:

Compulsory Clean-up, in charge of Mr. Zappe.

Insecticide Investigations, Mr. Turner in coöperation with Dr. C. H. Batchelder.

Date of Planting Experiments, conducted by Mr. Turner.

Enforcement of the Compulsory Clean-up

Section 2125 of the General Statutes provides that the Director of the Connecticut Agricultural Experiment Station shall issue and publish orders, rules and regulations, regarding the destruction or treatment of cornstalks, plants or parts of plants for the control of the European corn borer. Director Slate issued the following clean-up order:

European Corn Borer

Clean-up Order for 1937

Pursuant to the provisions of Section 2125 of the General Statutes of Connecticut as amended by the General Assembly of 1935, I, William L. Slate, Director of the Connecticut Agricultural Experiment Station, do hereby issue orders, rules and regulations, as follows:

That throughout the entire State, on account of the European corn borer, *Pyrausta nubilalis* Hbn., all cornstalks, stubble, and the larger weeds in and around the corn fields, and all infested stalks of dahlia or other flowering or vegetable plants, be disposed of by feeding to live stock, burning, or plowing under cleanly, on or before April 25, 1937.

(Signed) W. L. Slate
Director

February 23, 1937

As a method of enforcing this order, on April 26 eleven inspectors were assigned to work in 73 towns. The towns selected were those along the shore of Long Island Sound and inland along the larger rivers where most

*Of the Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture.

of the sweet corn is grown and where the European corn borer has been most abundant and destructive. These men scouted for cornstalks and corn stubble, which according to the law and the clean-up order should have been disposed of by April 25. All persons having cornstalks on April 26 are violators of this statute. The inspectors were instructed to report all such violations to the prosecuting attorney of the city or town, or to a grand juror of the town, in which the violations occurred.

Most of the prosecuting officers were rather reluctant to make wholesale arrests, and therefore notified each violator immediately to dispose of his cornstalks and stubble, with the warning that if this was not done before a specified date, he would be arrested and tried. One of the prosecuting officers gave the inspector a written and signed order to that effect, to be shown to all violators in that town. On the whole the prosecuting officers coöperated very well with the inspectors, and a large proportion of violators cleaned up their land without further trouble. Even with this coöperation and warning system some failed to clean up and the law enforcement agents found it necessary to arrest and try 43 violators, most of whom were given a minimum fine and all were required to clean up and to pay the costs of the court.

All this inspection work was completed by the end of May, at which time adult moths were emerging from the overwintered cornstalks. The inspectors were required to furnish their own automobiles for which they were paid on a mileage basis. Altogether the inspectors traveled 18,050 miles on this work, and the total cost of the enforcement inspection, including wages, mileage and other necessary expenses, amounted to approximately $2,251.40.

Insecticide Investigations

Coöperative experiments with the Federal Bureau of Entomology and Plant Quarantine, Division of Cereal and Forage Insects, have been continued. A summary of the results obtained in 1935 and 1936 was published in Bulletin 395, and revised suggestions to growers in Circular 118. The work in 1937 showed that the spray and dust materials suggested in Circular 118 continued to provide a high degree of protection to both early and late sweet corn. The spray which contained one pound of pure ground derris or cubé root (4 percent rotenone) in 25 gallons of water, with a suitable spreader, was slightly more effective than the dual-fixed nicotine dust (4 percent nicotine). Application of the dust with hand dusters was more effective than with a four-row vegetable duster. Late sweet corn, maturing in September, was successfully treated by applications on August 5, 9, 14, 20 and 27. There was well over 80 percent reduction in borers and a high increase in percentage of borer-free ears.

These treatments have been tested sufficiently to demonstrate that the materials, method of application and time of application are highly satisfactory.

Dahlias were treated with the following sprays: (1) pure ground cubé root (4 percent rotenone), one pound in 25 gallons of water with a suitable spreader; (2) nicotine tannate and dusts (a) dual-fixed nicotine dust (4 percent nicotine) and (b) cubé dust (one percent rotenone). Applications

were made August 2, 9, 16, 25, and September 1, 8 and 15. All treatments were satisfactory, but the cubé spray was somewhat less effective than the other treatments.

Date of Planting in Relation to Corn Borer Injury

The relation between time of planting corn and infestation by the European corn borer, *Pyrausta nubilalis* Hubn., has been considered by several investigators. Most of the observations have been made in the area infested by the one-generation phase, but Schlosberg and Mathes[1] noted eggs of the second generation in Ohio in 1936.

This report is concerned with varieties of sweet corn grown in southern Connecticut in the area infested by the two-generation phase. The purpose of the work was to determine: (1) the relation between date of planting and amount of corn borer injury; (2) the relation between date of maturity and corn borer injury and (3) the need for application of insecticides to various plantings.

Corn was planted at intervals of approximately 10 days from as early in April as possible until July 10. One 150-foot row of each variety was planted on each date. As the ears matured they were examined for corn borer infestation. Ear infestation was the only criterion considered in the results. The work was carried on in 1935, 1936 and 1937. The varieties used were Spancross C-2, an extra early yellow hybrid; Whipcross P-39, a midseason yellow hybrid; and Redgreen, a late white hybrid.

The 1935 season was somewhat later than in the other two years, and the average temperature for May was three degrees below normal. April temperatures were below normal in all three years. The corn borer infestation was most severe in 1937, especially in the second generation. In 1935 the infestation was somewhat heavier than in 1936.

The results are given by varieties in Tables 3, 4 and 5. In general there is closer correlation between date of maturity and infested ears than between date of planting and infested ears. For instance, Spancross C-2 planted in April was always more heavily infested than Redgreen planted on the same dates. In all three seasons the corn maturing during August was less heavily infested than that maturing in July or September, with the exception of Redgreen planted in April, 1935 and 1936. There was, of course, some minor variation in percentage of ears infested, that is, the earliest corn and latest corn was not always the most heavily infested.

Growers in Connecticut usually plant an extra early variety of corn during April or early in May for July marketing. Midseason varieties and late varieties are planted later in May for August maturity. As a rule, the late corn (maturing in September) is a late variety planted in June. Fortunately it appears from these tests that the August crop, which is the largest portion of the sweet corn grown in Connecticut, will escape the most serious infestations. In fact the infestation of this corn has been too low to justify the application of sprays or dusts to control the corn borer. On

[1]Egg and Larval Populations of European Corn Borer in Relation to Time of Planting and Yields of Sweet Corn. Jour. Econ. Ent., 30: 280.

the other hand, the early market corn was heavily infested, and in all three seasons the application of sprays or dusts was needed to produce a satisfactory crop of borer-free ears.

There was much variation in the second generation infestation (in September). The midseason variety was heavily infested two of the three years. The late variety was not so heavily infested. If the experience of 1937 is repeated, sprays and dusts to control second generation borers will be economically justifiable.

TABLE 3. DATE OF PLANTING AND CORN BORER INJURY

SPANCROSS C-2

Year	Date Planted	Date Picked	Percent ears infested
1935	April 25	July 16-23	44.8
	May 2	July 26-Aug. 1	63.3
	May 11	July 26-Aug. 5	34.9
	May 21	Aug. 5-8	8.0
	May 31	Aug. 5-12	3.6
	June 12	Aug. 12-19	1.3
	June 24	Aug. 23-29	20.0
	July 2	Sept. 3-13	42.6
	July 10	Sept. 16-20	44.5
1936	April 20	July 11-21	65.2
	April 30	July 15-21	55.8
	May 9	July 22-31	24.0
	May 19	July 25-Aug. 7	5.0
	May 28	Aug. 7-17	1.1
	June 8	Aug. 20-26	13.6
	June 22	Aug. 25-Sept. 3	23.4
	July 10	Sept. 14-16	32.3
1937	April 12	July 16-26	37.5
	April 20	July 19-25	77.8
	April 30	July 16-29	75.0
	May 10	July 26-Aug. 1	50.0
	May 21	July 30-Aug. 4	15.9
	June 1	Aug. 7-11	2.5
	June 10	Aug. 16-23	16.4
	June 21	Aug. 30-Sept. 3	38.1
	June 30	Sept. 3-8	23.5
	July 13	Sept. 11-23	58.3

TABLE 4. DATE OF PLANTING AND CORN BORER INJURY

WHIPCROSS P-39

Year	Date Planted	Date Picked	Percent ears infested
1935	April 23	July 26-Aug. 1	40.4
	May 2	Aug. 1-8	27.5
	May 11	Aug. 5-8	22.8
	May 21	Aug. 8-16	5.4
	May 31	Aug. 12-23	2.4
	June 12	Aug. 23-29	14.2
	June 24	Sept. 3-10	50.0
	July 2	Sept. 16-23	57.8
	July 10	Sept. 27-Oct. 1	50.0

TABLE 4—Continued

Year	Date Planted	Date Picked	Percent ears infested
1936	April 20	July 25-Aug. 7	72.0
	April 30	July 29- Aug. 7	59.1
	May 9	Aug. 3-14	12.9
	May 19	Aug. 7-17	1.0
	May 28	Aug. 17-24	9.7
	June 8	Aug. 26-Sept. 3	33.1
	June 22	Sept. 8-11	31.6
1937	April 12	July 23-Aug. 2	33.3
	April 20	July 27-Aug. 3	50.0
	April 30	July 30-Aug. 2	37.3
	May 10	July 30-Aug. 7	22.3
	May 21	Aug. 7-11	2.9
	June 1	Aug. 16-21	17.1
	June 10	Aug. 23-27	34.2
	June 21	Sept. 1-8	33.3
	June 30	Sept. 11-14	66.7
	July 13	Sept. 27	60.0

TABLE 5. DATE OF PLANTING AND CORN BORER INJURY

REDGREEN

Year	Date Planted	Date Picked	Percent ears infested
1935	April 23	Aug. 5-12	25.9
	May 2	Aug. 8-16	6.7
	May 11	Aug. 12-16	1.2
	May 21	Aug. 16-19	1.6
	May 31	Aug. 26-29	13.5
	June 12	Aug. 29-Sept. 3	33.3
	June 24	Sept. 16-20	33.1
	July 2	Sept. 20-Oct. 1	32.2
1936	April 20	Aug. 3-12	34.3
	April 30	Aug. 3-14	23.1
	May 9	Aug. 15-20	3.9
	May 19	Aug. 17-24	14.1
	May 28	Aug. 26-31	30.1
	June 8	Sept. 3-8	33.4
	June 22	Sept. 14-16	6.9
1937	April 12	Aug. 2-9	9.1
	April 20	Aug. 4-9	5.9
	April 30	Aug. 7-9	12.5
	May 10	Aug. 11-16	0.0
	May 21	Aug. 16-21	8.9
	June 1	Aug. 23-27	15.6
	June 10	Aug. 31-Sept. 3	22.3
	June 21	Sept. 8-10	0.0
	June 30	Sept. 14-18	37.5

JAPANESE BEETLE WORK IN CONNECTICUT, 1937

J. Peter Johnson and Philip Garman[1]

Scouting

Seasonal scouting for the adult Japanese beetle began on July 12. A total of five crews, each consisting of one foreman and three scouts, reported for work at the Connecticut Agricultural Experiment Station, and were given one and one-half days of schooling in the methods of scouting for Japanese beetles. Five one-half ton Ford canopy trucks were furnished for transportation by the United States Department of Agriculture. On the afternoon of July 13, two of the crews which were under the supervision of the New Haven office began scouting nurseries and greenhouses in their respective districts and finished on September 10. The other three crews, which were under the Boston office, proceeded to their respective bases on the afternoon of July 13, began scouting the nurseries and greenhouses in their districts on July 14 and finished on September 11. The crews were stationed at Bridgeport, Hartford, Middletown, New Haven and Storrs, and were paid out of Federal funds.

As in past seasons, each crew followed an itinerary and scouted classified nursery and greenhouse establishments, their sub-divisions, and others desiring classification, four to five times. Altogether there were 94 establishments, comprising 169 growing units scouted within the State. The minimum distance examined around each firm was 1,000 feet, and altogether 355 beetles were found. In addition, the men scouted from one to four times each, the premises of 118 dealers in sand, soil, peat and manure and one orchard establishment. Four beetles were found on the premises of two manure sources scouted. Results of the scouting in Fairfield County indicate a large increase in the number of beetles found in that section during the season.

Summary of Findings

Location	Dates found	Number of beetle
Branford	Aug. 13	3
Darien	July 14, Aug. 12	2
Glastonbury	July 14, 21, 23, 29	9
Greenwich	July 17	6
Hamden	July 19	15
New Canaan	July 16, 21, Aug. 17	4
New London	Between July 21 and Sept. 7	99
Old Greenwich	July 19, 30	11
Ridgefield	July 22, 24, 26, 27, Aug. 7, 9, 10, 21, 24	163
Rowayton	July 16, 29, Aug. 12	10
South Norwalk	Aug. 11	1
Stamford	July 20	5
Stratford	July 28, Aug. 7, 20, Sept. 3	14
West Haven	July 13, 27, Aug. 6, Sept. 2	15
Yalesville	Aug. 13	2
Total beetles found		359

[1]The portion dealing with scouting, trapping, inspection, certification and Japanese beetle survey is by Mr. Johnson, and that about parasite introduction and beetle populations is by Doctor Garman.

Trapping

Japanese beetle traps baited with liquid bait composed of geraniol and eugenol were placed in certain towns not known to be infested, beginning July 6, to learn whether or not beetles were present. Twenty-five traps were placed in Cheshire, 25 in Clinton, 30 in Colchester, 25 in Cromwell, 25 in Durham, 25 in Guilford, 25 in Lakeville, 25 in Madison, 25 in Norfolk, 50 in Southington, 50 in Stafford Springs, 30 in Thompsonville, and 17 in Woodbury. As soon as it was determined that beetles were present in a town, the traps were removed and placed in other towns not known to be infested. These traps remained in the field until September 10. The table below lists the number of beetles captured during the season and the towns where they were caught.

BEETLES TRAPPED

Location	Dates found	Number of beetles
Clinton	Aug. 19	1
Durham	Aug. 19, Sept. 1	2
Guilford	July 23, 29, Aug. 10, 13	7
Lakeville	July 19, 26, Aug. 2, 6	12
Madison	Aug. 10, 12	43
Norfolk	Aug. 9	1
Southington	Aug. 17	2
Stafford Springs	Aug. 4, 11, 20	3
Thompsonville	July 21, 27, 30	19
Total beetles trapped		90

Inspection and Certification

As in past seasons, the district inspectors were able to take care of the farm products quarantine inspection work in addition to their regular routine duties.

Inspection points were located as follows:

Location	No. of Inspectors
New Haven	2
Manchester	1
Middletown	1
Westerly, R. I.	1
Total	5

Kind and amount of products certified:

Products	Amounts
Corn	5 bags.
Beans	18 bus.
Apples	1 bu.
Peaches	961 baskets.
Cut flowers	40 boxes.

The total number of plants inspected and certified for shipment to other states and foreign countries were 6,128,175, while 10 carloads of sand and soil were shipped to other states.

The number of certificates issued is shown below:

CERTIFICATES ISSUED

Kind	Farm products	Cut flowers	Nursery and ornamental stock	Sand, soil	Manure	Total
"A"	27	30	43,364	74	0	43,495
"B"	6	1	7,175	93	0	7,275
Stamp	23	9	1,045	0	0	1,077
Total	56	40	51,584	167	0	51,847

General Japanese Beetle Survey

During the summer of 1937, Japanese beetle infestations throughout the State were general at the original locations. Marked increases were noted in Branford, Bridgeport, Greenwich, Hartford, New Canaan, New Haven, Ridgefield, and in East Hartford. A heavy infestation was noted in the East Hartford meadows along the Connecticut River. Although some of the infestations did not show any great increase, there seemed to be a general spread of the insect and many new infestations were found. As a result of the trapping activities carried on during the summer, nine new towns were found to be infested, with a total of 90 beetles having been captured, a somewhat higher number than in previous seasons.

A general survey was made of the older infestations in the State. It was somewhat less extensive than in 1936, because the survey was carried on by means of traps. The table below gives the brief results of this survey.

Date	Extent of infestation	Date	Extent of infestation
	*Bridgeport**		*New Haven**
July 26	Heavy	July 12	Heavy
	Danbury		*Norwich*
July 22	General	Aug. 6	Light
Aug. 4	(3 Ellsworth Ave.) 1 P.J.		
	Groton		*Old Saybrook*
Aug. 6	Light	Aug. 6	Light
	*Hartford**		*Stamford*
July 28	General	July 14	Light
Aug. 16	Heavy		*Torrington*
	Mystic	July 19	None
Aug. 6	Very light		*Wallingford*
		Aug. 14	Light

*The towns of Bridgeport, Hartford and New Haven were checked by traps for emergence records and population as well as the towns of Branford, Canaan, Greenwich, New London, Putnam and Ridgefield. The records of the first emergence as well as the last day beetles were captured during the season are recorded in Table 6, together with the total number of beetles captured during the season. The information recorded in this table is given from traps other than those regularly visited and recorded in the adult beetle population tables.

TABLE 6. EMERGENCE RECORD OF THE JAPANESE BEETLES TAKEN IN TRAPS DURING 1937

Location	Dates traps set	First emergence date and last date found	Total
CANAAN:			
West Main St.*	June 15—Sept. 7	None	None
GREENWICH:			
83 Arch St.*	June 15—June 29	June 23— 5 P.J.	42
HARTFORD:			
44 Oxford St.*	June 15—Aug. 30	June 29— 8 P.J. Aug. 30— 7 P.J.	410
Riverside Park*	June 15—Oct. 13	June 29— 3 P.J. Oct. 7—20 P.J.	6,924
NEW LONDON:			
12 Jay St.*	June 15—Oct. 13	June 24— 1 P.J. Oct. 7— 4 P.J.	2,600
22 Jay St.*	June 15—Oct. 7	June 29— 9 P.J. Oct. 1—12 P.J.	6,123
PUTNAM:**			
24 Tatem St.*	June 15—Oct. 21	July 6— 1 P.J. Sept. 28— 4 P.J.	246
106 S. Main St.*	June 15—Oct. 21	July 8— 1 P.J. Sept. 28— 4 P.J.	395
RIDGEFIELD:			
Lynch Estate*	June 15—Oct. 7	June 23— 2 P.J. Oct. 7—20 P.J.	17,023
			33,763

* All locations had two traps either for the whole season or part of it.
** At 94 S. Main St., numerous beetles were noted feeding; July 6, 1937.

During the past season, severe feeding by the Japanese beetle was observed in Bridgeport on grapevines, native evening primrose, and in one or two localized areas, on lindens, Schwedleri maples, sweet cherry and plum. Light feeding was noted on white birch clumps, elms, weeping willows, sycamore, mountain ash and blackberries. Figure 6 shows the beetles feeding on a hollyhock leaf.

The Japanese beetles in Bridgeport were so numerous that they were a definite pest. General feeding occurred in localized areas in Branford, Danbury, Greenwich, Hartford, New Haven, New London, Ridgefield and Stamford. At Riverside Park, Hartford, Conn., the turf and grasslands had been treated with arsenate of lead in the early fall of 1936 and the results obtained were so successful that no feeding was noted on the elms in the park. The previous year general light feeding took place on most of the elms there. However, considerable infestation was found and the beetles were concentrated more or less in a field where the hay and weeds had purposely not been cut. They were feeding on the native evening primrose growing there.

Turf injury caused by the grubs of the Japanese beetle was observed in Branford, Bridgeport, Greenwich, Hartford, New Haven, Ridgefield and Stamford. Localized turf areas in Danbury, New London and Putnam were infested to such a degree that if fall rains had not been plentiful, visible injury would have occurred. Property owners in many of these towns found it necessary to treat the lawns with arsenate of lead to prevent the continuance of grub injury.

Definite records have been made of beetle infestations in 62 towns within the State. The number of infested towns has been increasing each year and from the degree of infestation in many of the towns now infested, we may expect a more rapid spread to other towns.

Grub diggings to determine local or localized grub populations for the purpose of liberating parasites were made in Bridgeport, Danbury, Greenwich, Groton, Hartford, Mystic, Norwalk, Norwich, New Haven, New London, Putnam, Ridgefield and Stamford.

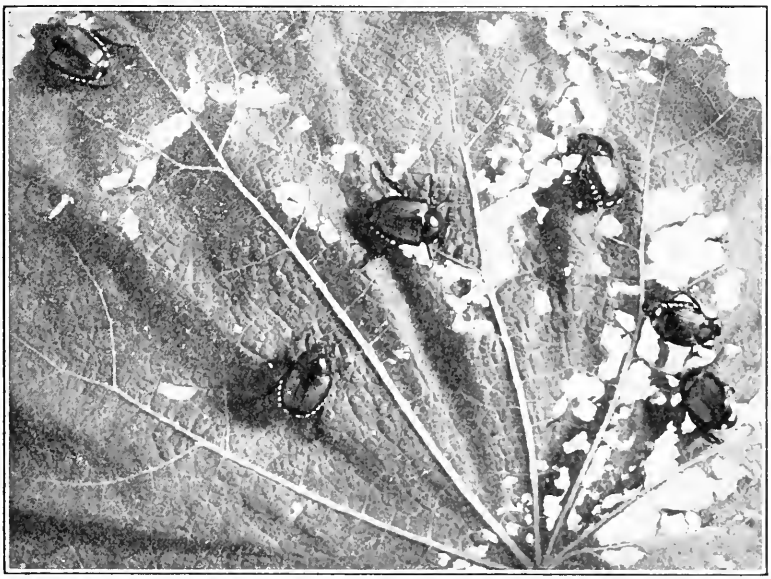

FIGURE 6. Japanese beetles feeding on a hollyhock leaf. Natural size.

Turf injury caused by the Japanese beetle, Asiatic beetle, Asiatic garden beetle and *Ochrosidia villosa*, the latter a native insect recently appearing in this State, has occurred in all the shore towns from Greenwich to New Haven. The varying habits of these insects are such that any turf area within these towns may become infested at any time. Much confusion has resulted because of these four insects infesting a contiguous area and the grubs from all of these insects are mistaken in general to be that of the Japanese beetle. However, control measures are the same for all and the turf can be protected by the use of arsenate of lead.

Japanese Beetle Parasite Introduction

Following the location of Japanese beetle centers of infestation by digging and scouting, the United States Bureau of Entomology and Plant Quarantine placed in Connecticut during 1937 one colony of *Centeter cinerea* Ald., four colonies of *Tiphia vernalis* Roh., and five colonies of *Tiphia popilliavora* Roh. *Centeter cinerea* is a parasitic fly attacking and destroying the adult beetle, and the others are digger wasps which burrow in the soil and lay their eggs on the grubs. The areas where parasites have been placed to date include: Bridgeport: 3 colonies *T. vernalis*, 3 colonies *T.*

popilliavora; Branford: 1 colony *T. vernalis*, 1 colony *T. popilliavora*; New Haven: 1 colony each of *T. vernalis* and *popilliavora*; New London: 1 colony *T. vernalis*; Ridgefield: 2 colonies *T. vernalis*; East Hartford: 1 colony *T. popilliavora*; Hartford: 1 colony *Centeter cinerea*. In all, 15 colonies of parasites have been placed in Connecticut during 1936 and 1937.

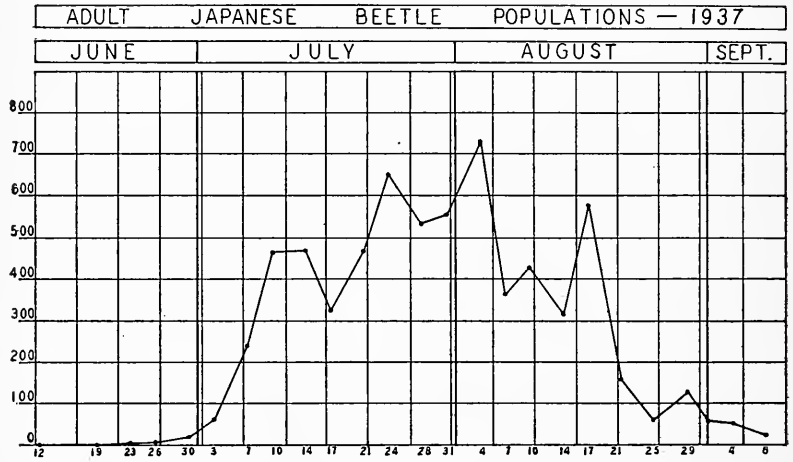

FIGURE 7. Chart showing adult Japanese beetle populations in Branford, Bridgeport and New Haven. Trap records.

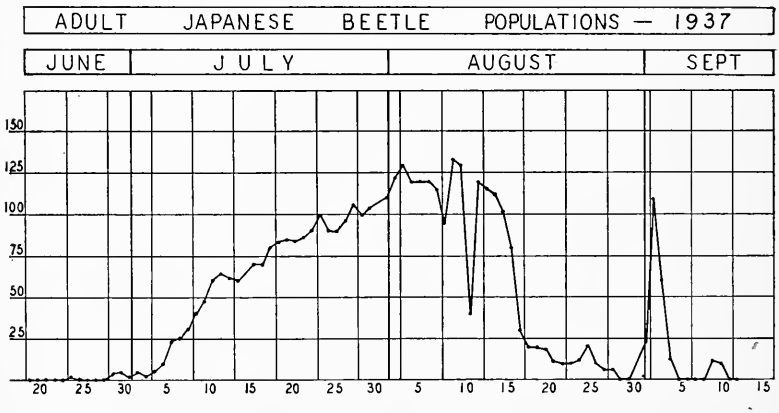

FIGURE 8. Chart showing adult Japanese beetle population in Ridgefield. Trap records.

Recoveries of *T. vernalis* were attempted during May, 1937, and they were found to have passed the winter successfully in two of the four locations where colonies were liberated in 1936. Live adults of *vernalis* were collected in Bridgeport and New Haven. A checkup shortly following the

Hartford liberation of *Centeter cinerea* indicated that the flies had laid eggs abundantly on the beetles. This locality is considered somewhat more favorable for *Centeter* than the Bridgeport area where it was liberated a number of years ago but failed to become established. Whether it will survive at the Hartford location, however, remains to be seen.

Adult Japanese Beetle Populations

In order to get an idea of the relative abundance of the Japanese adult beetles during the summer, regular trap collections were made at Ridgefield, Bridgeport, New Haven and Branford. This work was done by Messrs. Smith and Devaux and the charts prepared by Mr. Smith show that the beetle is most active during the last half of July but that it continues to be active during August and part of September. In several cases this year there was a secondary peak of abundance about the first of September, the exact meaning of which is obscure. This flurry occurred at Branford, Bridgeport, New Haven and Hartford. There is also an indication of the same rise in abundance shortly after the first of September in our records for 1936. Figures 7 and 8 give this data graphically for 1937.

THE ARMYWORM IN CONNECTICUT

W. E. Britton

An outbreak of the armyworm, *Cirphis unipuncta* Haw., occurred in Connecticut in 1937, and caused damage to crops in Hartford, Litchfield, New Haven, New London, Tolland and Windham counties. Although no reports of its occurrence in Fairfield and Middlesex counties came to my attention, it is quite probable that it was present in these counties and also in many other localities of which I have no records.

A severe outbreak of the armyworm was observed by me in Hartford in 1896, and the insect did some damage that year in New Haven and in Springdale. The last serious outbreak, in 1914, was rather general and caused much damage. Although a few moths or caterpillars are seen each year, it is only in occasional seasons that the armyworm occurs in sufficient numbers to cause an outbreak, or to damage severely the grass and grain crops upon which it feeds.

In 1917 this insect was reported from Northford and Orange, but only a few caterpillars were seen and they caused no damage. In 1919 there was a small outbreak in Woodbury in a field of oats. The grain was cut in August and there were many caterpillars on the ground underneath the straw, and pupae were found in the soil. Some caterpillars were also observed on corn in Hartford and Tolland counties. In 1925 small outbreaks occurred in Milford and Wallingford, where timothy grass was somewhat damaged. In 1930 a few specimens were received from Berlin and New London, but there was no damage. In 1931 a caterpillar was received from Manchester, feeding upon corn. In 1933 caterpillars injured corn in Orange but the insect was not generally prevalent. In 1935 caterpillars were present in a hayfield in Northford, but the insect was not prevalent and no reports of its presence in other localities were received in this office.

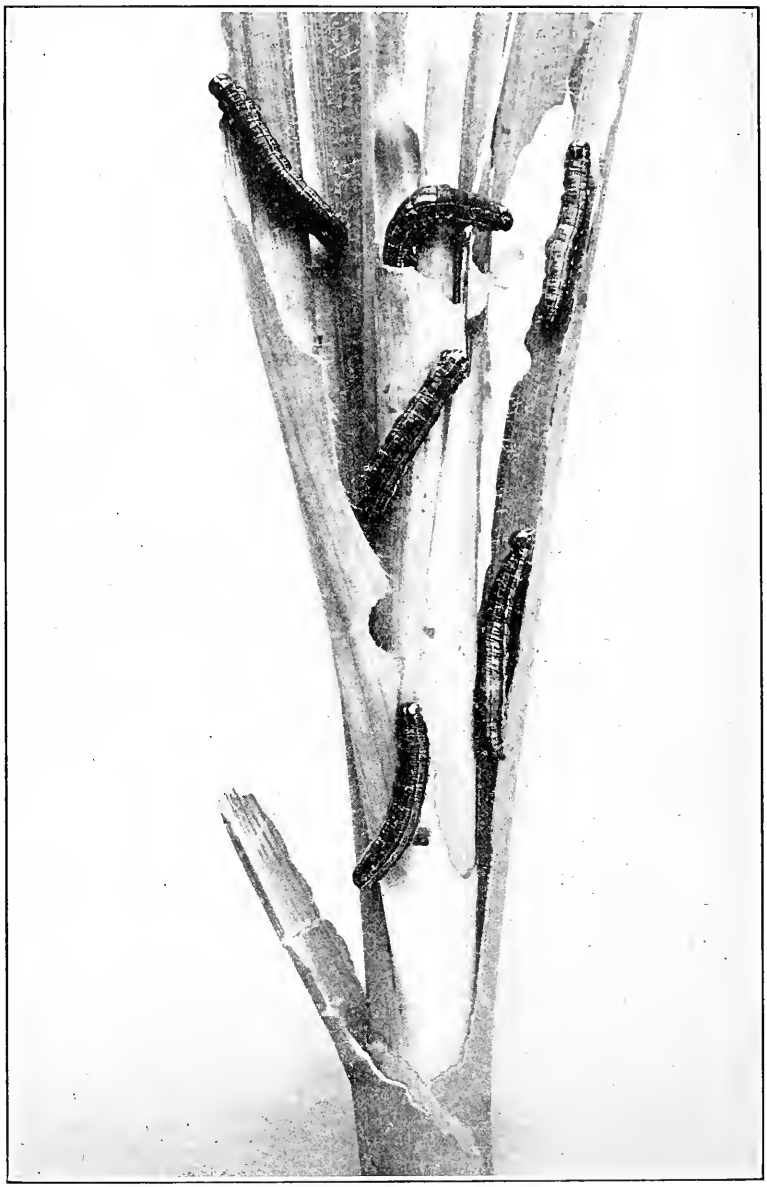

FIGURE 9. Armyworms feeding on corn. Natural size.

The Outbreak in 1937

HARTFORD COUNTY: The Farm Bureau reported a moderate infestation of armyworms as present on three farms in Berlin, July 24. No details were given regarding crops infested or the amount of damage, if any. In Newington, six acres of oats that were being cut for fodder while green, were heavily infested. The field had been seeded to alfalfa in the oats and the owner feared that the caterpillars might devour the alfalfa plants. Professor S. P. Hollister, of the Connecticut State College at Storrs, reported by telephone that the insect was present in an orchard in Farmington, and on July 20 Dr. R. B. Friend, in company with Mr. Russell S. Anderson of the Hartford County Farm Bureau, visited the infested fields in Newington and Farmington. He reported that about five acres of grass in the apple orchard in Farmington had been destroyed. As this grass was used only as a mulch under the trees, it did not seem to be so serious as if it were harvested as hay. Later the owner reported that this grass never recovered.

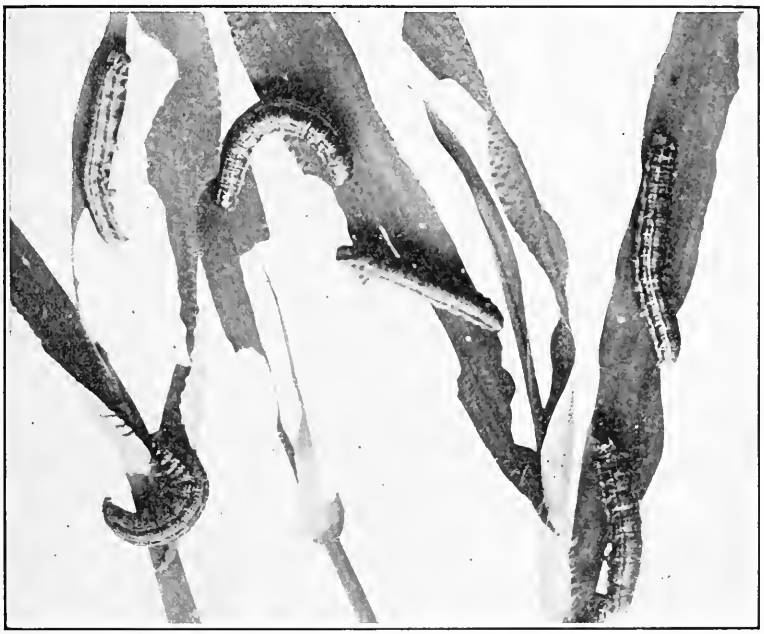

FIGURE 10. Armyworms feeding on grass. Natural size.

LITCHFIELD COUNTY: The Litchfield County Farm Bureau reported that the armyworm had appeared on two farms in Torrington. In one instance there was a light infestation in second crop hay and no damage. The other was on a farm in the Torringford section where three acres of oats were destroyed or partially destroyed. The leaves and heads had all been eaten off and many of them devoured, leaving only the bare stalks.

New Haven County: On July 19 caterpillars were received from an infestation in Guilford, south of the Post Road and opposite the intersection of the North Branford Road. Mr. Johnson visited the place on July 21 and found the caterpillars feeding on the grass and clover in a sod apple orchard, between four and five acres in extent. This grass received the drip of the lead arsenate spray applied to the apple trees and when the caterpillars fed upon it most of them were killed. An acre field of sweet corn adjoining the orchard was not sprayed and was severely damaged. Many of the caterpillars in the cornfield were parasitized but the degree of parasitism was not determined. The New Haven County Farm Bureau reported an outbreak in Southbury, where approximately two or three acres of oats were destroyed.

The writer observed a few armyworms on weed grasses in the gardens and also saw and captured several adults in New Haven, but no large numbers occurred and no damage was seen or reported in the vicinity of New Haven.

New London County: The only infestations in New London County that came to my attention were reported by the New London County Farm Bureau, and were as follows: Two infestations in Griswold, one field heavily infested, and a field of three acres, lightly infested, food plants not indicated. In Lyme a two-acre field heavily infested and a three-acre field lightly infested, food plants not stated. In North Stonington a field of about 10 acres of oats was heavily infested and probably severely damaged.

Tolland County: The Tolland County Farm Bureau sent specimens and reported to Prof. J. A. Manter at the Connecticut State College, Storrs, under date of September 7, 1937, regarding an infestation of armyworms on Mile Hill, Coventry, where about two acres were infested and some Hungarian millet, corn and rowen were destroyed. This infestation occurred so late in the season that it may possibly have been a later generation. I did not see specimens, but Professor Manter examined the specimens submitted and pronounced them armyworms.

Windham County: On July 22, Professor S. P. Hollister of the Connecticut State College at Storrs, telephoned that he visited an apple orchard in Hampton and saw armyworms feeding on the grass in the orchard. Evidently it was a rather light infestation and covered only about an acre. On the following day the Windham County Farm Bureau reported that 25 acres of fodder oats in Brooklyn had been severely damaged as nearly all of the leaves had been devoured. At this time the armyworms had nearly reached larval maturity. On August 2 further reports were received from the Farm Bureau. About three acres of millet in East Killingly were moderately infested and in about 15 acres of apple orchard in Woodstock the grass was heavily infested. The lead arsenate in the orchard sprays killed many of the armyworms but there were enough of them to kill most of the grass before the poison took effect.

Life History and Habits

There are at least two generations each year in Connecticut and probably a partial third, with perhaps three complete generations in

certain seasons. Davis and Satterthwait[1] record three complete generations and a partial fourth at La Fayette, Ind. Entomologists do not agree on the hibernating stages. Some believe that the insect passes the winter as a partially grown caterpillar; others claim that it winters as a pupa, but J. B. Smith[2] recorded finding adult moths "during the entire winter in sheltered places". On the other hand, Slingerland[3] claimed that it did not winter as a moth in the latitude of Ithaca, N. Y.

Records of adults in the Station collection, taken early in May, indicate that they passed the winter either as adult moths or as pupae from which the moths emerged early in the season.

The female moth may lay as many as 700 eggs, usually in clusters of 50 or less, placed in the sheath or at the unfolded base of a blade of grass or grain, and covered with a whitish adhesive substance which holds them together and fastens the edges of the leaf firmly around them. Usually the rankest and most vigorous bunches of grass are selected for this purpose. From eight to ten days are required for these eggs to hatch.

FIGURE 11. Armyworms coiled up on ground under straw. About natural size.

During the first two larval instars the caterpillars "loop" when they crawl, like Geometrid larvae, and spin down on silken threads like canker worms. After the second molt they lose the looping habit. They molt five times before reaching larval maturity, all within a period varying from 20 to 30 days. When fully grown, the armyworms go into the ground an

[1] Jour. Agr. Research, 6, p. 799. 1916.
[2] New Jersey Agr. Expt. Station Rept. p. 450. 1896.
[3] Cornell Agr. Expt. Station, Bul. 133, p. 297. 1897.

inch or two beneath the surface and excavate cells or cavities in which they transform to the pupa stage. The moths emerge from 10 to 15 days afterwards.

The moths usually remain hidden during the day, but are strong fliers, somewhat attracted to lights and strongly attracted to sweetened baits and decaying fruit. In ordinary seasons the caterpillars feed upon the grasses and weeds in low meadows and swamps and usually on land that is neither pastured nor cultivated. When extremely abundant and in need of food they travel together in large numbers, moving in the same direction like armies, suggesting the common name of armyworm. It is only at such times that they destroy grass and grains, (see Figures 9 and 10) and it is said that an outbreak has occurred. They are half grown or more when they march over the land seeking new fields to devour.

In grass and grain fields that are heavily infested at harvest time a large proportion of the caterpillars hide under cocks, shocks and windrows, and by moving or overturning these, large numbers of caterpillars are exposed and may be eaten by poultry and birds. (See Figure 11.)

FIGURE 12. Pupae and pupal cell of the armyworm. Natural size.

FIGURE 13. A Tachinid parasite of the armyworm. *Winthemia quadripustulata*. Twice natural size.

Description

EGG. The egg is white or pale yellow, nearly spherical and almost smooth, but finely marked with white ridges or striae, and slightly less than a millimeter in diameter. They are laid in rows in clusters of from 10 to 50, in the sheath or in the unfolded leaf, and covered with a transparent gelatinous substance.

LARVAE. The caterpillar is about one and one-half inches in length when full grown, although it varies from one and one-fourth to one and three-fourths inches. It varies considerably in color but is usually brown with tints of green or red, much darker above than beneath, and marked dorsally with narrow longitudinal stripes of white, yellow or lighter brown. A broader yellow stripe extends along either side just below the spiracles. The entire under surface is a lighter brown than the upper surface. The

head is light brown, shining, with an inverted V-shaped mark on the face, and reticulated margins on the lateral surfaces of darker brown. The legs are light yellowish brown, and the prolegs are the same color as the under surface, except that each has a transverse dark band on the outer side, and the tip is marked with black on the inner side. The caterpillars are shown in Figures 9, 10 and 11.

Pupa. The naked pupa is nearly three-fourths of an inch in length, light reddish brown and glossy. The apex bears a pair of spines that are incurved at the tips. (See Figure 12.)

Adult. The female moth has a wingspread of about one and three-fourths, and the male about one and three-eighths, inches. Both sexes have fore wings of light brown or fawn color, the females usually darker than the males, and with more prominent markings. The female fore wings are more or less mottled, a rather conspicuous white discal spot or dot beyond the center, and with a dark line or streak, sometimes incon-

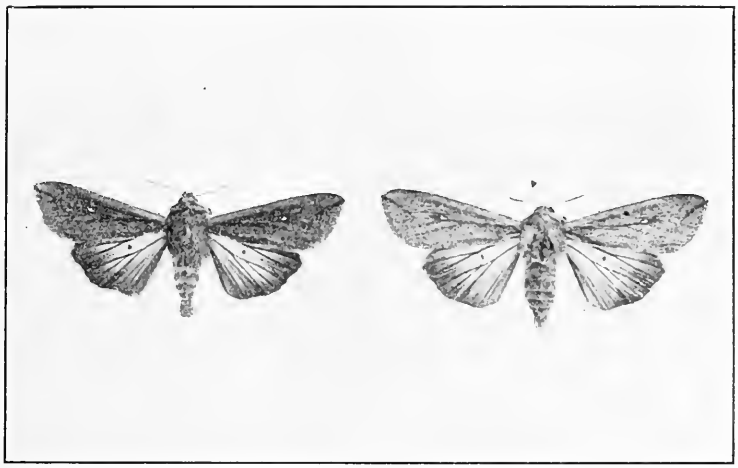

Figure 14. Armyworm moths, female at right. Natural size.

spicuous, nearly bisecting the apical angle. The hind wings are usually lighter at the base and darker and more blackish on the outer margins than the fore wings. The under surface of the fore wings is dark brown in the center with lighter brown margins; hind wings are light brown, each with a black dot near the center. The head, legs, antennae, body above and beneath, with some variations, are all about the same color as the upper surface of the fore wings. The adults are shown in Figure 14.

Natural Enemies

Domestic fowls and such birds as barn swallows, blackbirds, bobolinks, catbirds, robins, starlings and thrushes, destroy large numbers of army-

worms in Connecticut. Even the English sparrow has been observed to feed upon them. Other vertebrate animals such as hogs, skunks, frogs and toads are known to eat many armyworms.

The larger ground beetles of the genera Carabus and Calosoma are perhaps the most important of the predaceous insects that feed upon armyworms. Some of the caterpillars are killed by certain predaceous soldier bugs of the Family Pentatomidae. However, the true parasites are more important than those insects just mentioned, for holding the armyworm in check. Of these probably the three most important in Connecticut are two large two-winged Tachinid flies, *Winthemia quadripustulata* Fabr., (see Figure 13), and *Belvosia unifasciata* Desv., and a small four-winged fly, *Apanteles militaris* Walsh. These parasites were all reared from armyworms in 1914, and the white oval eggs of the Tachinid flies, fastened to the bodies of the armyworms back of the head, were observed in several localities. A bacterial wilt disease also killed many of the caterpillars.

Control Measures

Several control measures are possible in dealing with armyworm outbreaks. Some of these are: pasturing with domestic fowls; spraying with poison; use of poisoned bait; barriers; and cultural practices.

Pasturing with domestic fowls: In small infestations near the buildings, the hens, ducks, geese and turkeys should be turned into the field and they will eat large numbers of armyworms. In case the crop of grass or grain has been cut and there are windrows, cocks or bunches of hay or straw, or shocks or bundles of cured oats or other grain, these should be moved or turned over to expose the armyworms hiding underneath. Likewise piles of weeds and rubbish around the margins of the field should be disturbed for the same reason. Birds will also assist the domestic fowls in disposing of the caterpillars as soon as the armyworms have been uncovered.

Spraying with poison: Advancing armyworms may be headed off or checked by spraying with poison, strips of grass, grain or corn around the infested field or between it and other fields not infested. For this purpose lead arsenate or calcium arsenate may be used at the rate of 3 pounds in 50 gallons of water. Many of the caterpillars will feed upon the poisoned strips and be killed. Of course, such poisoned grass or grain cannot safely be used for fodder, and should be burned or used only for mulch or compost.

Poisoned bait: One of the most effective control methods is said to be the use of poisoned bait against armyworms. This is particularly true when their food is scarce and there is danger that they may migrate to a nearby field and destroy the crop. The usual cutworm bait may be used for this purpose. Metcalf and Flint[1] give a formula as follows:

25 pounds dry bran
3 gallons water
2 quarts cheap molasses
1 pound sodium arsenite, white arsenic or Paris green

The water, molasses and poison should be stirred together thoroughly and mixed completely with the bran so that every particle is moistened. This

[1] Destructive and Useful Insects, p. 319. 1928.

should make a rather dry, crumbly mixture that will hold together when squeezed in the hand. If too dry, add more water; and if too moist, add more bran. This bait should be scattered thinly by hand or by a broadcast seeder, late in the afternoon. Poultry should not be allowed access to the field where the poison bait has been applied.

Barriers: Barriers in themselves do not kill armyworms, but temporarily halt their advance from one field to another so that large numbers congregate in one place where they can easily be killed. One of the commonest barriers is formed by plowing a deep furrow across the line of march with the perpendicular side facing the infested field. The armyworms will crawl into the furrow and, finding it difficult to get out, will crawl along in it, often by the thousand, several layers in depth, tumbling over each other. These may be crushed by dragging along the furrow a log six or eight feet long and with a diameter small enough to lie well down in the trench. The caterpillars may also be killed by spraying with kerosene or other contact insecticide. Barriers may be formed with windrows of dried straw, weeds or brush, and burned after large numbers of caterpillars have crawled upon, or under, them.

Cultural practices: Small areas, and particularly lawns, that are infested may be rolled with a heavy roller to crush the caterpillars. On badly infested grain fields it is usually advisable to remove the straw at once, thoroughly disk-harrow the field or give it a shallow plowing and harrow thoroughly. Many of the caterpillars and pupae will be crushed and many others exposed so that birds can eat them. In fact, fall plowing of badly infested fields is usually advisable because of the reasons just stated. If grain is nearly ready to cut when first attacked, it may be saved by harvesting immediately and carting it to an uninfested field to be cured. As soon as it becomes partially dry, the armyworms will not eat the leaves or pedicels.

Literature

The following list of references contains only some of the more readily accessible articles that are thought to be of greatest value to Connecticut readers. Many of the published articles on the armyworm are inaccessible and a complete bibliography would fill several pages. A more complete list of references to the early literature of this insect was published in the Report of this Station for 1914, page 172.

Britton, W. E. The Army Worm (*Leucania unipuncta* Haw.). Brief account of 1896 outbreak. Rept. Conn. Agr. Expt. Sta., pages 236–238, 1 plate. 1896.

———— Outbreak of the Army Worm. Full account of the 1914 outbreak. Rept. Conn. Agr. Expt. Sta., pages 157–173, 5 plates. 1914.

Crosby, C. R. & Leonard, M. D. Manual of Vegetable-Garden Insects. Pages 288–292. MacMillan Co., New York. 1918.

Davis, J. J. & Satterthwait, A. F. Life History Studies of *Cirphis unipuncta*, the True Army Worm. Jour. Agr. Res., **6**, pages 799–812, 2 figures, 1 plate. 1916.

Drake, C. J. & Harris, H. M. Controlling Cutworms and Armyworms. Iowa State Coll. Agr. and Mech. Arts, Extension Bul. **194**, 8 pages, 8 figures. 1920.

Fernald, H. T. The Army-Worm. Mass. State Bd. Agr. Circ. **22**, 13 pages, 2 figures, 1 plate. 1914.

Flint, W. P. The Army-Worm. Ill. State Nat. Hist. Surv., Ent. Ser., Circ. **7,** 9 pages, 4 figures. 1920.

Garman, H. The Army-Worm. Ky. Agr. Expt. Sta., Bul. **137,** 21 pages, 16 figures. 1908.

Gibson, Arthur. The Army-Worm. Canadian Dept. Agr., Entomological Branch, Bul. No. **9,** 34 pages, 19 figures. 1915.

King, V. & Barber, G. W. Controlling the Army-Worm in Southeast Missouri. Jour. Econ. Ent. **14,** pages 486–488, 1 plate. 1921.

Knight, H. H. The Army-Worm in New York in 1914. N. Y. (Cornell) Agr. Expt. Sta., Bul. **376,** 17 pages, 8 plates. 1916.

Metcalf, C. L. & Flint, W. P. Destructive and Useful Insects. Pages 318–320. McGraw-Hill Company, Inc., New York. 1928.

Mickel, C. E. Army Worms in Southern Minnesota. Jour. Econ. Ent., **25,** pages 1123–1128. 1932.

Sanderson, E. D. & Peairs, L. M. Insect Pests of Farm, Garden and Orchard. (Page 110, Second Edition). John Wiley & Sons, Inc., New York, N. Y. 1921.

Sherman, Jr., F. Rearing of Moths and Tachina Flies from Larvae and Pupae of Army-Worm in North Carolina in 1914. Jour. Econ. Ent., **8,** pages 299–302. 1915.

Slingerland, M. V. The Army-Worm in New York. N. Y. (Cornell) Agr. Expt. Sta. Bul. **133,** 30 pages, 6 figures. 1897.

Walton, W. R. The True Army Worm and Its Control. U. S. Dept. Agr. Farmers' Bulletin **731,** 12 pages, 8 figures. 1916.

TESTS OF APPLE SPRAYS, 1937

M. P. Zappe and E. M. Stoddard

Tests of various apple sprays under commercial orchard conditions have been continued coöperatively for several years by the entomological and botanical departments of the Station, in the Station apple orchard at Mount Carmel. This orchard consists of 168 trees of 13 varieties, the majority of which are Baldwin and McIntosh.

Tests for the last few years have been conducted with the idea of eliminating the use of sulfur in the sprays, especially lime sulfur, because of the foliage injury that frequently accompanies its use. Recently it has been further noted that trees sprayed with sulfur were more apt to have serious infestations of European red mite than those sprayed with other materials. This is probably due to the fact that the sulfurs kill red mite enemies and allow the red mites to become numerous enough to cause foliage and fruit injury. The trees that were sprayed with lead arsenate, lime and fish oil had very few red mites present, even though no dormant sprays were used to kill their eggs.

A few commercial growers have been using the lead arsenate, lime and fish oil sprays on scab-resistant varieties with satisfactory results. In 1937 a few more growers used this spray for the first time and they reported good results at a substantial saving in the cost of materials.

Number and Time of Applications

For a number of years no dormant sprays have been used in the orchard. The prepink spray was also omitted in 1937 and the pink spray

on May 7 was the first application on all plots. The calyx spray on McIntosh, Duchess and Gravenstein was applied on May 20 and on other varieties on May 26. The reason for the different dates was that the first three varieties were ready for spraying on May 20 and the others were not through blooming until May 26.

All plots were again sprayed on June 3 and on June 17. The last application was on July 19, at which time lead arsenate and lime were used on all plots regardless of what the previous treatments had been.

It is to be noted that the materials used in any series of applications were included in all the sprays of that series: e.g., Dritomic sulfur was not preceded by lime sulfur in the early sprays, and no sulfur was used at any time on the lead arsenate, lime and fish oil plots.

Dry lime sulfur	6 pounds
Catalytic sulfur	4 "
Lead arsenate	3 "
Water	100 gallons

This formula was used on one plot consisting of seven large McIntosh, four Gravenstein and three Stark trees. Altogether five applications were made, beginning with pink spray (May 7) and ending with the last spray on July 19. Our method of scoring fruit at harvest time is not comparable to commercial grading of fruit as practiced by the fruit growers. With our method, an apple scoring "good" must be absolutely free from any insect or disease blemishes. An apple showing any injury, however slight, is scored as imperfect, although the fruit might easily pass into a commercial No. 1 grade. An apple with a tiny spot of scab no larger than the head of a pin would count as a scabby apple, as well as one that was almost entirely covered with scab.

Dritomic sulfur	5 pounds
Lead arsenate	3 "
Water	100 gallons

This material was used on 14 small and medium sized McIntosh trees which received the same number of treatments as the preceding plot. The smaller trees did not bear much fruit and were not included in the table of results.

Table 7. Sulfur Plots

	Dry lime sulfur, Catalytic sulfur McIntosh	Dritomic sulfur McIntosh	Check-no treatment McIntosh	Dry lime sulfur, Catalytic sulfur Gravenstein	Dry lime sulfur, Catalytic sulfur Stark	Check-no treatment Stark
Good	90.34	86.74	1.91	78.88	90.16	15.80
Curculio	4.07	5.13	53.40	14.44	8.03	57.88
Codling moth	.006	0	.01	0	0	.28
Other chewing insects	1.25	.7	21.23	1.05	.75	6.23
Scab	4.61	7.72	87.72	6.45	.93	44.99
Sooty blotch	0	0	0	0	.13	6.95

There was not much difference between the two sulfur plots, and what little difference there was favored the lime sulfur-catalytic sulfur plot, the main advantage being in the control of scab. Only one plot (lime sulfur-catalytic sulfur) had Gravenstein and Stark trees in it, so no com-

parisons can be made with the other sulfur plot and are merely included as a matter of record. It is interesting to note, however, that Gravenstein had more scab on sprayed trees than did the McIntosh apples.

Basic Copper Sulfate Plot

Basic copper sulfate	1½ pounds
Zinc sulfate	1 "
Lime	3 "
Lead arsenate	3 "
Water	100 gallons

The first treatment on this plot was applied on May 7 when a 4-4-50 Bordeaux with lead arsenate was used. We had intended to use basic copper sulfate all through the season but this material was late in arriving so we used the Bordeaux spray for the first application. Basic copper sulfate was used at the next spraying on May 20. At the time of the third spray (June 3) there was noticeable injury to the foliage and its use was discontinued on the McIntosh trees but was applied on all other varieties in this plot for the rest of the spray season. McIntosh trees were sprayed with lead arsenate, lime and fish oil for the remainder of the spraying season.

Table 8. Basic Copper Sulfate Plot

	Baldwin	Greening	Roxbury russett	McIntosh*	Fall Pippin
Good	81.59	89.84	93.45	89.9	71.16
Curculio	17.78	9.18	6.13	7.41	20.03
Codling moth	0	0	0	0	0
Other chewing insects	.41	.75	.10	1.16	1.42
Scab	.22	.28	.32	1.69	9.09
Sooty blotch	.02				

* Lead arsenate, lime and fish oil spray after calyx spray.

At harvest time the fruit from this plot was badly russetted except the Fall Pippin, which was practically free from it. This material controlled pests fairly well except that curculio injury was rather high on Baldwin and Fall Pippin and there was considerable apple scab on the latter. Scab on McIntosh was well controlled with only two applications of fungicide. On account of the two forms of copper sulfate used on this plot it is not possible to tell which material caused russetting, and the data should be regarded only from the point of view of pest control.

Lead Arsenate, Lime and Fish Oil Plot

Lead arsenate	3 pounds
Lime	10 "
Fish oil	1 quart
Water	100 gallons

The lead arsenate, lime and fish oil plot consisted of approximately 40 trees of several varieties, mostly scab-resistant kinds, although there were four Fall Pippin trees among the lot and these are very susceptible to scab infection. This plot like the others was sprayed five times with the above materials. At the last spraying on July 19, however, the fish oil was omitted in order to reduce the amount of spray residue at harvest time.

Table 9. Check Plot (no treatment)

	Baldwin	Greening	Sutton	Fall Pippin
Good	16.97	11.37	10.08	4.01
Curculio	66.38	58.53	74.68	67.98
Codling moth	8.20	1.30	15.02	2.70
Other chewing insects	18.23	8.15	17.81	7.48
Scab	8.71	18.88	19.53	83.94
Sooty blotch	28.87	51.52	20.82	

Table 10. Lead Arsenate-Lime and Fish Oil Plot

	Baldwin	Greening	Northern Spy	King	Sutton	Fall Pippin
Good	78.64	84.8	87.12	78.25	87.46	56.08
Curculio	18.54	5.69	7.56	14.70	7.84	8.94
Codling moth	0	0	0	.02	0	0
Other chewing insects	.73	.37	.27	.25	.15	.81
Scab	1.43	8.98	5.27	7.01	4.31	36.75
Sooty blotch	.97	.46	.14	.09	.35	0

All varieties of apples in this plot produced a good percentage of perfect fruit except Fall Pippin, which we knew would not because of apple scab. This disease is not very well controlled with the materials used and we do not recommend this treatment for scab-susceptible varieties. It is interesting to note, however, that the percentage of scab on sprayed Fall Pippin was nearly 50 percent less than on the unsprayed trees. Good curculio control was obtained on all varieties except Baldwin, which was planted on the outside of the orchard. Under these conditions curculio injury is always severe, particularly on Baldwin which is very susceptible. Other pests in this plot were light, in no case as high as one percent. All the fruit was well colored and had a good finish. A few red mites and aphids were present but not in great enough numbers to cause any noticeable injury to foliage or fruit and were apparently held in check by their natural enemies.

Lead Arsenate-Lime and Fish Oil at Greenwich

Mr. Gowdy at Conyers Farm tried the lead arsenate-lime and fish oil combination on Greening this season, in comparison with his regular spray schedule. He used one spray exactly as we do except that he cut the amount of lime from 10 pounds to 8 pounds per 100 gallons. His regular spray schedule is as follows:

Prepink Spray

Liquid lime sulfur	1-1/3 gallons
Sulfur	2-2/3 pounds
Lead arsenate	3 "
Lime	8-1/3 "
Water	100 gallons

Pink Spray

Liquid lime sulfur	2/3 gallon
Dry wettable sulfur	3-1/3 pounds
Lead arsenate	3 "
Lime	8-1/3 "
Water	100 gallons

CALYX AND LATER SPRAYS

Dry wettable sulfur	3-1/3 pounds
Micronized sulfur	1-2/3 "
Lead arsenate	3 "
Lime	8-1/3 "
Water	100 gallons

Two separate plots of Greening were used for this test, nearly identical except that the lead arsenate-lime and fish oil plot was surrounded by woodland and the other plot was part of a large orchard surrounded by other varieties of apple. Six applications were given the sulfur plot, beginning with prepink and ending in early July, while the other plot received five spray applications, on the same dates as the first, except that the prepink spray was omitted.

TABLE 11. RESULTS AT GREENWICH

	Regular schedule	Lead arsenate-lime and fish oil
Good	88.7	82.74
Curculio	8.89	15.48
Codling moth	0	0
Other chewing insects	1.35	.61
Scab	.59	.82
Cedar rust	.57	.52

From the preceding table of percentages obtained by scoring the fruit at harvest time, it may be seen that the regular spray was apparently a little better than the lead arsenate-lime and fish oil plot. The difference is about 6 percent more of perfect fruit when the regular spray schedule was applied than on the lead arsenate-lime and fish oil plot, due to the increased amount of curculio injury on the latter. This may be explained by the fact that the lead arsenate-lime and fish oil plot was practically surrounded by woodland, where curculios find ideal overwintering quarters. It has often been noted that trees on the outside of an orchard are always more heavily infested with curculios than other trees in the orchard. This is particularly true when orchards adjoin wood or brush land. We feel confident that if the tests are carried on another year the figures will be reversed. Furthermore, the cost of the regular spray is considerably more than the cost of the lead arsenate-lime and fish oil spray.

Cedar Rust Control on Wealthy

This season's work on cedar rust control produced negative results in that there was not enough infection on either check or treated trees to show any difference. This circumstance cannot be accounted for because cedar trees with a heavy infection of galls were planted among the apple trees and should have produced abundant infection. Last year we accounted for this by the fact that the cedars were not protected from the spray applied to the apples, but this year the cedars were covered at each spraying.

Lime sulfur and lead arsenate at the usual strengths were used with Casein glue at the rate of 4 ounces to 100 gallons as a spreader and sticker. The sprays were applied on the same dates as given for the other plots.

As sprayed and check plots showed a variation of only .73 percent, no conclusions can be drawn on cedar rust control. A commercial Wealthy orchard treated by the owner in a similar manner showed excellent control of cedar rust where previously it had caused serious damage.

DORMANT SPRAYS FOR CONTROL OF PINE LEAF SCALE

M. P. Zappe

The pine leaf scale, *Chionaspis pinifoliae* Fitch, has become very abundant throughout Connecticut in the last few years. About 20 years ago this insect was rather rare and during the annual inspection of nurseries might be found only three or four times, but in 1936 it was found in 72 nurseries. Home-owners are having considerable trouble with the scale on ornamental plantings around their dwellings, or in any crowded or protected situation. Individual specimen trees in exposed situations are seldom infested. This insect is shown in Figure 15.

Figure 15. The pine leaf scale. Twice natural size.

It is a well known fact that the pine leaf scale may be controlled by spraying with contact insecticides just after the eggs have hatched. Practically nothing has been published about its control during the time the host plants are dormant and when the insect is in the egg stage.

In Connecticut there are two broods each year. The overwintering eggs hatch about the latter part of May and the second brood hatches late in July or early in August. Spraying with contact insecticides soon after the hatching periods will hold them in check. Nurserymen and others

have failed in attempts at control, probably because their summer sprays have not been timed properly. For this reason there was need of a dormant spray that could be applied at any time between fall and early spring.

In the fall of 1936 tests of various materials were made at West Hartford on a block of small mugho pines in a nursery. All pines were nearly of the same size, about 12 to 15 inches high with tops about two feet in diameter. The degree of infestation varied on the plants but all were more or less infested. On October 21, 1936, sprays were applied, with from 6 to 10 plants in each plot. Table 12 shows the materials applied, their dilution, and effectiveness.

Table 12. Dormant Spray to Control Pine Leaf Scale
Applied October 21, 1936. Results Recorded April 23, 1937

Materials applied	Dilutions	Percentage kill
Liquid lime sulfur	1 part in 9 parts water	90
Kerosene Emulsion (with soap)	1 " " 20 " "	40
Straitar	1 " " 16 " "	36
Spracream	1 " " 16 " "	14
Sunoco	1 " " 32 " "	10
Scalecide	1 " " 16 " "	20
Emulso	1 " " 24 " "	5
Kleenup	1 " " 32 " "	1
Nursery Volck	1 " " 32 " "	2
Straitar + Spracream (equal parts)	1 " " 32 " "	2

The first examination of scales was made on December 16 and at that time practically all the eggs appeared to be alive, although a few shriveled eggs were found in each plot. On April 23 a second scale count was made of all sprayed plots. At this time there were many dead eggs on all plots and scales were dropping off.

Later in the season there were young scales present on all pines except the lime sulfur sprayed plot.

Spring Sprays

All materials at the same strengths were again sprayed on another lot of mugho pines on April 30, 1937. At this time the new growth had started and buds had grown to about an inch in length. On June 15 the pines were examined for young scales and some were present on all plots except those mugho pines sprayed with liquid lime sulfur. The plots sprayed with Straitar, Spracream, Kleenup and kerosene emulsion had only a very few young alive. In the Sunoco plot only an occasional young scale could be found. On the other plots young scales were present in large enough numbers to produce a heavy reinfestation after the second brood matured. No young could be found on any of the trees sprayed with lime sulfur.

On August 21 all sprayed mugho pines were again examined. At this time the second brood young had hatched and young scales were abundant on all plots except those sprayed with five percent kerosene emulsion and lime sulfur. On the latter there were no scales present on the new growth,

although some of the old dead scales still adhered to last year's needles. On the kerosene emulsion plot an occasional young scale could be found. The results of these tests show that thorough spraying with liquid lime sulfur, one part to nine parts of water, will give approximately 100 percent control. It may be applied either in the fall or spring. When thoroughly sprayed with lime sulfur, the needles were somewhat discolored by the spray, which was visible for some time, but after growth started the new needles soon covered the sprayed ones and the pines looked normal again. All of the oil sprays reduced the infestation but one spraying is not sufficient to eradicate this pest. There was no noticeable injury to any of the mugho pines by the oil sprays or any of the other materials, even when sprays were applied after the new growth had started.

CASE STUDIES IN TERMITE CONTROL

Neely Turner and M. P. Zappe

Despite the voluminous literature on the subject of termite control, there is still controversy over the efficacy of metal termite shields. As stated in previous publications, this controversy is being carried on by companies using chemical methods of termite control. It is the writers' belief that the real basis of the controversy is the fact that entomologists do not accept chemical treatments as permanent and lasting control methods in all infested buildings. The criticisms of termite shields have been along the following lines: (a) That shields are experimental; (b) that shields cannot be installed in many buildings; (c) that shields are too expensive for use in anything but new construction, and (d) that shields do not prevent entry by subterranean termites. Before presenting additional evidence of the effectiveness of metal shields, some discussion is necessary.

The exact origin of the idea of metal termite shields is at present unknown. The earliest reference found has been in the First Report of the Government Entomologist (1899-1900), Natal Department of Agriculture, published in 1901. In this report Fuller states, "In Australia it is a very common thing to see wooden houses built, clear of the ground, on piles; the piles being covered on top with a sheet of galvanized iron or zinc. The object of this is to prevent them [the termites] passing up into the timbers of the house." (1) According to Howard (4), Fuller worked in New South Wales, issuing publications in 1896, and left for Natal in 1897. This would establish the "common" use of metal plates to prevent entry of termites as prior to 1897, or 40 years ago. Froggatt (2) described these same tin or zinc caps in 1905 and again in 1913 (3). In both publications he says ". . . though not everlasting, they help to keep the pests out of all other woodwork." Jack (5), in South Africa in 1913, suggested the use of a "zinc ant course," consisting of strips of zinc laid on the first course of bricks and projecting one inch on each side of the wall. "This effectually prevents the termites from ascending the wall." References to the use of shields during the last 10 or 15 years are numerous and have been given elsewhere. The important point is that the principle of the use of metal termite shields is at least 40 years old, and therefore their use cannot be considered as experimental.

In all of these early publications, as well as in the recent ones, the only mention made of shield failure is that by Froggatt (2), which states that tin or zinc caps are "not everlasting." The deterioration of tin or zinc by corrosion cannot be classed as shield failure.

Shield installation is difficult in many types of buildings but by no means impossible. It may be that the cost of such installation is out of proportion to the necessity for it, but this does not alter the fact that, if necessary, effective termite shields could be installed in any building. Obviously, shields installed above the grade line cannot be expected to protect wooden portions of the building below. So far as the writers know, there has been no satisfactory shield developed to protect wooden basement floors laid on cinders or on concrete. Suggestions for elimination of termites under such conditions include replacement of wood with materials containing no cellulose, or use of pressure-treated wood.

Metal termite shields are expensive to install. In actual cases in Connecticut the cost has been from two to ten times the cost of a thorough chemical treatment for the same buildings. In one or two cases the estimates for shielding have been no higher than estimates for necessary repairs and a chemical treatment. In these cases the repairs were of such a nature that shields could be installed during the repair work at no additional expense except for the sheet metal and labor of fitting it. It is, of course, true that there are many buildings in which the cost of shielding actually exceeds the value of the building. Each case must be handled according to the conditions, and there are many other factors besides the actual termite infestations in the buildings. These factors have been discussed previously (6). In actual practice a great many owners of buildings, after a careful consideration of all the facts, have not hesitated to install metal termite shields.

During the course of termite investigations in Connecticut, much information on the efficacy of metal shields has been obtained. At the same time some observations of chemical treatments have been made. The results of these studies are given in the form of case histories of the buildings in question, and supplement similar studies published previously (7).

Complete Shielding of Infested Buildings

In all cases cited below, the shields have been installed according to specifications except where noted. This means that the shields are joined together to make a continuous sheet, that all wooden porches have been either shielded or placed on concrete bases, that wooden bearing posts have been replaced by lally columns or piers, and that there is no unshielded woodwork extending from the ground to the framework of the building above.

With the exception of the five buildings in Case No. 2, all of these buildings were seen and carefully examined *before* control work started and at least once after the work was completed. They were all infested before shields were installed. This list includes *all of the shielded buildings which have been examined before and after shielding* and is not made up of selections from a larger group. Records of many new buildings shielded during construction are available but will not be included in this study.

1. A small wooden dwelling built in 1921 on hollow concrete block foundation, with basement. Termites were discovered in 1933 and had apparently entered through wooden basement window frames and through wooden posts supporting the wooden porches. In 1933 the house was completely shielded, metal basement window frames substituted and brick supporting piers built under the porches. The sills were sprayed with hot creosote. Examination in 1936 showed no signs of termites. According to present standards, this shield was rather crude, but it has been effective.

2. A series of five ordinary wooden frame dwellings built on stone foundations laid in lime mortar. Two buildings were heavily infested by termites and three only lightly infested. All had at least one partly excavated extension. These buildings were shielded in 1933 under competent supervision but with unskilled labor. All extensions were excavated to provide at least two feet clearance, and the wood of all porches was isolated from the ground. In 1936 there were no signs of termite infestation. The shielding was not done according to specifications but has been effective to date.

3. This was a small colonial house at least 150 years old. Part of the house had a basement, but in two rooms the wooden floors rested on the ground. The house was first examined early in 1932 and was very badly infested and in a dangerously weak-

ened condition. The owner employed a builder to make repairs and to install a termite shield. The shield was designed and the installation supervised by the owner. The "shield" consisted of a four-inch strip of sheet copper inserted between the bricks for about two inches and held in place by cement mortar. In the basement a similar strip was inserted at a different level. In the unexcavated portion the strip was inserted *above* the floor level. This type of installation is not a metal termite shield and it did not stop termites. Late in 1935 termites were active in the unexcavated portion of the house.

4. A modern house built about 1922, with a stone foundation, two earth-filled masonry porches, and two sills actually below grade level. In 1933 termites were discovered by a flight coming from a sill adjoining one of the masonry porches. An exterminator took a contract to eliminate termite damage for a five-year period. The treatment consisted of dusting Paris green in the termite galleries in infested wood. The following year another flight occurred and the treatment was repeated. In 1935 two flights were seen and a careful examination showed serious damage to sills and joists. The owner decided to shield the building and the contractor advised raising the entire house one foot. This was done and termites have caused no more trouble.

5. A large house four stories high with a stone foundation, wood framework with a stucco finish, about 20 years old. There were two large masonry porches allowing termite entry. In places the foundation had a false stucco finish over wood, which also allowed termites to enter. There was a full basement under the entire house. The house was shielded during the summer of 1935, a few weeks after termites had been found. There have been no signs of termites since the work was completed.

6. A modern house about 10 years old in 1934, when termites were discovered. There was a full basement and one large and one small terrace. The foundation was of stone, the house, wood-framed, and the sill was within three inches of the ground. A termite shield was installed and the grade lowered slightly to give more clearance. There have been no more signs of termites.

7. An old colonial house, to which two wings had been added without excavation. In 1934 termites were found, and inspection showed a very serious infestation. All parts of the house were heavily infested and many joists were seriously weakened. A termite shield was installed in the spring of 1934. Inspection three months later showed that termites were still active in two places, (1) a large beam kept wet by water which condensed on a refrigerator pipe above, and (2) a side wall kept wet by a leak in the roof. The roof leak was repaired, the refrigerator pipe insulated and no more termites have been seen.

8. A branch library building finished in 1918, with concrete foundation, brick walls, and wood joists and floors. The basement floors were concrete, the outside basement walls wood furred, wood lathed and plastered, and basement partitions of wooden construction. All spreader blocks had been left in to serve as nailing blocks for furring, and the furring strips and partition plates had been placed before the basement floor was laid. Termites were active in the furring and in some partitions when they were discovered in 1935. An addition built in 1930 had no finished basement, but had a clearance of six feet between wood and the ground. No termites were found in the addition. The interior basement partitions were placed on 6-inch concrete bases and shielded, and a metal termite shield installed above grade. In finished basement rooms the shield was brought out to the plaster line. Below the shield, metal furring and lath were used, and when the job was finished the shield edge showed through the plaster but did not extend into the rooms. In the addition, a treatment of orthodichlorobenzene was used according to Snyder's method. No termites have been seen since the work was completed, the last examination being made in December, 1937.

9. A large house built in 1920 on the framework of an old barn. There was a basement under 30 percent of the floor, one large masonry porch and a sidewalk above the sill along one side of the building. One end of the building was set in a large bank. Termites were abundant and had caused much damage on three sides of the building when the infestation was discovered in 1935. The building was about 30 by 50 feet in size. Two chemical control companies submitted bids for treatment, one at $250 and the other, $400 plus excavation and replacements. The owner rejected the $250 bid because it called for a soil treatment by trenching two feet deep and took no account of the unexcavated area or of the end of the building adjoining the bank. In this latter place, termites were coming out through the stone foundation 18 feet below grade level. The other bid was also rejected because the total sum bid was insufficient to buy the proper quantity of the specified treating fluid.

In the fall of 1935, the owner excavated 150 cubic yards of material to make a full basement and shielded two sides of the building. Although the shielding was not done entirely according to specifications, termites made no attempt to cross it in either direction. Six months after the shield was installed, the owner found a constantly increasing pile of dead worker termites in the middle of the basement floor. Investigation disclosed that these termites were dropping from a large beam (8 x 12 inches) above. Apparently this beam, which had previously rested on the unexcavated area, was just drying out enough to kill the termites.

Termite activity continued in the wall adjoining the bank, since there was no shield to prevent them from entering. In 1936 this end of the building was shielded. The work was difficult because of the construction. The first floor sill rested on a stone foundation 4 feet thick, and the studding was about 15 inches from the stone retaining wall. The second-floor sill was supported by the stone retaining wall. The contractor installed a shield for the second-floor sill and pilaster shielding where the outside walls butted against the retaining wall. The thick foundation under the first floor sill was partially removed, and the first-floor sill was carried on brick piers with a separate shield on each pier. This shielding has been satisfactory. The fourth side of the house is still unprotected, except for lowering the outside grade 12 inches.

10. A large dormitory built in 1919, with concrete foundations and basement floors, brick walls, wooden joists and wooden floors, and some wooden partitions in the basement. In 1935 termites had weakened one wooden bearing partition seriously. Entry was through the partition shoe which was placed before the concrete floor was poured, and through spreader blocks left in the concrete foundation. Termites were very abundant in and around the entire building. The weakened bearing partition was replaced by a brick partition and the entire building shielded. As in Case No. 8, the shield on the inside was just visible in the plaster.

This building was reinspected once in 1935 and twice in 1936, and no sign of termite activity was seen either above or below the shield.

11. A large wooden dwelling connected with the building described in Case No. 10. This building has a stone foundation with brick underpinning, and is about 40 years old. The basement floors were of wood and laid on cinders. These floors were badly damaged by termites. In addition termites had entered the sills in several places through the "dead-air space" in the brick underpinning. The entire building was shielded and a concrete floor laid in the basement. The wooden porches and porch steps were supported on concrete and shielded. The work was done in 1935, and three inspections made since that time have disclosed no signs of termite activity except one short shelter tube built on the foundation wall below the shield.

12. An old colonial dwelling, with a full basement and two feet clearance under an addition made in 1928. There was the usual large stone fireplace foundation in the basement. In 1918 several wooden posts were set to support the floor and in 1928 several more added. The latter year a concrete floor was laid, but the posts were left in contact with the dirt floor. In 1935 these posts were seriously weakened. In fact, the entire first floor was in bad condition. The building, including the fireplace foundation, was shielded. It was necessary to replace every first-floor joist, all sills, and some studding in the old part of the building. Two examinations have been made since the work was completed and no termites have been seen. There were two abandoned shelter tubes on the foundation below the shield. The last examination was made in the fall of 1937.

13. An old colonial house on a dry stone wall foundation, the sills practically at grade level. There were two small basements with dirt floors and about one-third of the floor space was not excavated. Termites were moderately abundant when discovered in 1935, and there was some damage to the sills and joists. When the house was repaired in 1928, one sill was found rotted and the original oak was replaced by fir. In 1935 this section of fir sill was almost entirely consumed by termites. The house was shielded, the basement completely excavated, and the grade lowered to give a clearance of six inches between the ground and the shield. The shield has effectively stopped the termites.

14. An old colonial house with two partially excavated wings, dry stone wall foundation, and the usual large chimney foundation. Termites were discovered in 1936, at which time several joists had been seriously damaged. A metal termite shield was installed, but the chimney foundation was not shielded. A soil treatment using a 2 percent strength of Phinotas oil was used in and under this founda-

tion. A few weeks after the shield was installed, re-inspection showed that termites were crossing down over the shield in four places. Three of these four tubes were in places where the shield did not meet specifications: (1) a flat plate under a door frame, (2) a poorly crimped lock joint, and (3) a place where the shield was bent down to clear a water pipe. The fourth place was beneath a large beam where termites had dropped a large shelter tube down to a shelf on the foundation. The three imperfections in the shield were corrected and the large tube destroyed. There has been no further activity at these points.

A second inspection in October, 1937, revealed that termites were still at work in the chimney foundation and had reached the joists through it.

This building had been vacant for several years prior to 1936, and the framework was very wet from leaks. Apparently the termites had sufficient moisture to keep them alive until the tubes were completed. Since the house has been heated this source of trouble has disappeared.

15. An old colonial house with a partly excavated addition and an unexcavated porch, heavily infested by termites in 1934. An exterminator agreed to treat the building and keep termites out for five years for $75. The original treatment consisted in drilling holes in the infested sills and dusting in Paris green. When flights occurred a year later, some sort of soil treatment was used outside the building, but the operator either overlooked or ignored the unexcavated area under the porch. Flights occurred annually and in 1937 the house was shielded. The large chimney base was removed, and the area under the porch was opened into the main basement and partially excavated. The shield was installed according to specifications.

One month after installation, inspection showed that the termites had dropped tubes *down over* the shield in the area under the porch. These tubes were broken off and the sill above painted with a material containing creosote. The soil was treated with a one percent solution of sodium arsenite. Two additional inspections have shown no signs of further termite activity.

16. An old colonial house with a partially excavated extension. Early in 1936 this house was heavily infested throughout and the joists were buckling in several places. The floors had settled seriously and a contractor advised temporary shoring. The building was shielded according to specifications. Most of the first-floor framework was so badly damaged that it was replaced. No termites have been seen since the shield was installed.

17. A modern house about 20 years old, with stone foundation and a partially excavated extension. There were several wooden partitions and two sections of wooden floors in the basement. The house was built on sloping ground, and along two sides wooden bearing walls covered with stucco and resting on a few stones replaced the foundation. These walls were lathed and plastered on the inside. All partitions, the wooden floor and the outside wooden basement walls were heavily infested and seriously damaged. Three chemical treating concerns examined the building and none of them discovered that the outside wooden bearing walls had settled two inches. In fact, none of them noticed that these walls were wood instead of stone. The estimates for chemical treatments varied from $125 to $425, and no estimate mentioned the necessity of repairs.

On his own initiative, the owner decided to shield the entire building. The wooden basement floors were replaced by concrete and basement partitions either removed or placed on a concrete curb and shielded. The outside wooden bearing walls were rebuilt and shielded. In December, 1937, several months after the work was completed, there were no termites found either above or below the shield.

Buildings Partially Shielded or Structural Changes Other Than Shielding

The buildings included in the following group were only partially shielded or were protected by structural methods other than shielding.

18. An old colonial dwelling with a large chimney foundation and an unexcavated extension; in part of the house the sills were practically at grade level. The foundation was a dry stone wall. The infestation was discovered in 1932, when many flights occurred and the joists and sills were found to be badly damaged. The system used was based on the report of O'Kane and consisted of replacing all infested sills with new sills which had been treated with creosote. In addition, a trench

was dug around the building, filled with cinders and saturated with a .5 percent solution of Phinotas oil in water. The unexcavated extension was not treated, although it was pointed out as a source of trouble.

In 1935 the entire building was treated by a chemical control concern. This concern reported that termites were working in the building. However, investigation showed that the current termite attack was confined to the untreated extension.

19. A wooden laundry building on piers, one side of building below grade level, dirt around several girders. The clearance under the building varied from four feet to none. Along the side below grade a few termites were found in 1935. Subsequent examination showed that practically no damage had been done by termites. There was wooden sheathing to the ground on two sides of the building, but no termites were found here. The entire floor was badly rotted due to the lack of ventilation under the building and to water spilled on the floor during laundry operations. A chemical treating concern proposed to treat the building after excavation was made.

After considering the rotten condition of the floor and the heavy load of laundry machinery, the writers suggested placing the machinery on a solid concrete floor and treating the soil for termites. A building inspector found that the load was excessive even for a sound floor of that type, and the concrete construction was followed. There has been no termite trouble since the work was completed.

20. An old institutional type of building, on stone foundations with 18-inch brick walls. Wooden floors were placed on wooden joists set in the wall. There was a full basement under part of the building and four feet clearance under all of it. Along one side the joists and floor were badly damaged by termites in 1935. The room above was used for storage and was usually full of canned goods. The floor had settled in previous years and was shored in several places. One section of flooring had been renewed several times because of "rot". Careful examination showed that part of the storeroom floor had settled as much as four inches. Additional shoring was used until a decision on repairs was reached. Those in charge decided to replace this floor with concrete. When the wooden floor was removed, it was found that the brick wall had a four-inch "dead-air space" through which termites had entered. No termite control measures were used because those in charge expected to replace the building with a new one within five years.

21. A wooden frame house about 30 years old, with a full basement, stone foundation and brick underpinning. There were termites found in a sill in May, 1935. The bearing posts and all basement window frames were wood, but were not infested. Sill damage was so bad that it was necessary to replace the sill to prevent settling. At the same time a metal termite shield was installed along one side of the house, all wooden posts were replaced by lally columns and wooden window frames with metal frames. The work was completed in the summer of 1936, and no termites have been found since then.

22. A wooden frame house in the same block as Case No. 21, and of similar construction. Termites had entered the sill through a wooden cellar hatchway. Along one side of the building the foundation was in bad condition and was rebuilt. At the same time a metal termite shield was installed at slight additional expense. Three sides of the building were shielded in 1936, and the only sign of termites since was a shelter tube on the basement wall below the shield.

23. A wooden frame house between Cases 21 and 22. The original examination made in 1935 disclosed termites in one basement window frame, in a stack of lumber stored on the dirt floor of the basement and in the basement stairs which rested on the dirt floor. A year later serious damage was found in one sill of the building. The property was not valuable enough to justify the cost of shielding. All basement window frames were replaced by metal frames, and the basement stairs placed on a concrete base. A soil treatment consisting of a .5 percent emulsion of Phinotas oil was used around the entire building. This treatment was made by driving a perforated tube in the soil and pumping the solution in under pressure. Two months later termites were just as active as they were before treatment. A second treatment was made by trenching to a depth of 18 inches and flooding the trench with a 4 percent emulsion of Phinotas oil at the rate of two gallons per linear foot of trench. Six months after treatment termites were just as active as ever, and a year after treatment activity continued. So far as could be seen, the two soil treatments did not affect termites in the least.

Infested Buildings Treated by Commercial Termite Control Companies

24. An old colonial house with a dry stone wall foundation, bearing posts set in the dirt basement floor, and one small unexcavated extension. The bearing posts, joists and sills were badly damaged by termites in May, 1935. The owner considered both shielding and chemical treatments and selected a chemical treatment consisting of an impregnation of sills and ends of joists by a liquid forced into small holes. The company's specifications called for replacement of the wooden bearing posts and basement window frames and excavation of the unexcavated area. A contractor had to make many replacements including lally columns for the wooden bearing posts. However, a wooden coal bin directly on the ground, basement window frames and a basement door frame were not replaced. The cost of the changes and replacements was $105 and of the chemical treatment $375, a total of $780. The minimum estimate for replacements and shielding was $1400. Two years after the treatment no termites were found in the house. The owner reported one flight of termites from the ground adjoining the cellar hatchway nine months after treatment.

25. An old factory building with a partial basement, the girders supported on piers. A severe attack of termites was discovered in 1935 but the building was not seen by the writers until 1937. After necessary replacements, a treatment including impregnation of timbers and a soil treatment was made in 1935. Flights occurred in 1936 and 1937 from a point where the floor was actually below outside grade level. Two re-treatments had been made but termites were still active.

26. An old factory building with a wooden floor supported on piers, about two feet clearance between the ground and the floor. The floor was practically at grade level. This building adjoined the one in Case 25 and was treated at about the same time by the same method. Termites "swarmed" in 1936 and again in 1937, coming out of the floor along the outside walls. So far, retreatments have failed to stop termites in this building.

27. An old colonial house with a modern unexcavated extension, and an unexcavated kitchen. This was typical in construction with a large chimney foundation and dry stone wall foundation. Termites were not very abundant in 1936 but had attacked timbers in the fireplace base, a sill and a few joists. The extension was excavated to provide three feet clearance, lally columns replaced wooden bearing posts and the building was treated by wood impregnation and a soil treatment. Contrary to specifications issued by the company, the kitchen floor was removed, the joists and soil treated, and the floor relaid. The treating job appeared to be very thorough; that is, at especially susceptible points there were numerous treating holes and the timbers were covered with a crystalline deposit left by the treating fluid. No termites were found in the one re-examination made nine months after the treatment.

These four cases are not adequate for a discussion of the effectiveness of the method of impregnation of timbers in place to control termites. Although all four buildings were treated by the same process, there was a wide variation in thoroughness of application. This concern issues instructions for structural changes which, if followed, would aid greatly in termite control. In two of the four cases the instructions were not carried out completely. The two buildings in which termites continued to work after treatment are very difficult cases, because wooden framework is set in foundations below grade level. In the writers' opinion the adequate control is the replacement of these wooden floors with concrete.

Cases Involving Unusual Factors

28. A modern stone-veneered building with the untreated wooden sill below grade level. In 1935 termites had entered a sill in a partly excavated area by means of a long shelter tube constructed over the concrete foundation. This tube was broken off and the soil underneath it saturated with creosote. There was a large masonry terrace at one end of the house. The owner had been in touch with a chemical treating concern which made a reasonable estimate for treatment. However, the sales letters and advertising literature were full of statements that aroused his ire, because he was familiar with the termite control information issued by the United States Department of Agriculture. The statements implied that this particular company had been compelled to work out control measures for termites because there was no information available on the subject in 1929. The owner had in his files government publications giving comprehensive accounts of termite control issued in 1929 and earlier.

The construction of the building made shield installation both difficult and expensive, and after some deliberation the owner decided to wait a year before taking any steps. After two years, termites appeared in the sill adjoining the masonry porch. The owner then contracted for the chemical treatment.

29. A small dairy building on a concrete foundation with a concrete first floor and a basement. Termites had entered through a large crack in the foundation and had damaged the wooden sill and joists. They had also reached the cork lining in a large cooler and destroyed it. A termite control company examined the building and estimated the cost of a chemical treatment of the soil at "in excess of $375". On questioning by the owner, the salesman stated that most of the cost was attributable to the difficulty in finding and killing the queen termite. The owner enlarged the crack in the foundation and filled it with concrete. The sill above was soaked with hot creosote and more creosote was poured on the ground adjoining the crack. The total cost was $15 and no termites have appeared in the building since.

30. A large library building of brick, steel and concrete construction. The only wood in the basement was in a few wall shelves in one room. The outside basement walls had wooden furring, metal lath and plaster. Termites were found by a control company salesman in a wooden storm entrance built entirely outside of the building proper. Entry was through a crack between two slabs of granite. The company proposed a treatment of the entire building at a cost exceeding $2,000. Since no termites could be found in the building itself, and since termites could not weaken the structure, the librarian decided to protect the entrance by sealing up the crack and proper use of a metal plate. The cost was $25.

31. A small modern bank building, of brick, stone, steel and concrete, with a basement. Termites were flying from a drain in the basement floor. The only wood in the building was walnut panelling on the first floor, which was at least two feet above grade. The directors rejected a bid for chemical treatment because the cost seemed out of proportion to the damage termites might do. An inexpensive treatment using a 2 percent emulsion of Phinotas oil in and around the drain was tried. The following spring termites were still present in the same location.

32. A small modern house three years old in 1935. A termite control company examined the building and proposed a treatment "to wipe out the present colonies" and prevent any further infestation. The report did not state that termites were present in the house, but the salesmen identified a swarm of insects at a kitchen window as termites. The estimate on the treatment was $298.

Several hours' work failed to show a termite or any termite damage in the building. Moreover, fence posts, plant stakes and wood buried in the ground showed no signs of termites. Stumps on adjacent vacant lots were apparently not infested. The insects at the kitchen window were small wasps of the genus *Crabro*.

33. A modern house with little susceptible construction except coal bin studs set in the concrete basement floor. A control operator had reported termites in the studs as well as on the ground outside the house. The owner saved the specimens for identification. The animals in the studs were Crustaceans, commonly called "sowbugs". The insects on the ground were ants of the genus *Lasius*.

34. An old colonial house with two large modern additions (unexcavated) and two large masonry terraces. There were two basements separated by a rock ledge. On three sides of the house, rock ledges were within one foot of the grade level. The owner had discovered termites in 1935 and had many of the damaged timbers replaced by untreated timbers. In 1937 he received two bids from two different concerns to apply chemical treatments. Both companies proposed to impregnate the wooden sills and apply a soil treatment. The bids were $348 and $543. The owner was advised that shield installation under such conditions would be very expensive, and that it would be necessary to blast away at least two feet of the rock ledge to make the shield effective. The property had a high assessed valuation because of its location, but the house itself was valued at a comparatively low figure. The owner decided on a chemical treatment and selected the company making the high bid on his own initiative.

35. A small factory building constructed on untreated wooden piers, with wooden floor and framework and corrugated iron roof and siding. Several of the piers were infested by termites and there was some damage to the floor. A treating company had proposed a chemical treatment, the cost being one-fourth of the insured

value of the structure. The maintenance superintendent intended to replace the building with a modern fireproof structure within five years. It was suggested that the building be inspected twice a year for structural safety and that no money be spent on termite control. This was accepted by the superintendent.

These cases are cited to show: (a) That there are many cases in which chemical treatments are more logical than shield installation; (b) that chemical control companies attempt to apply the same treatment to all buildings regardless of the termite infestation, and (c) that there are cases of misrepresentation which may be due to ignorance on the part of salesmen.

Discussion. These cases have been presented in four groups: (a) Complete shielding of infested buildings; (b) partial shielding or use of structural control measures other than shielding with or without soil treatment; (c) treatment by commercial companies using the method of impregnating wood and treating the soil, and (d) cases involving unusual factors, including instances in which other insects were incorrectly identified as termites. It will be noted that there are no cases of soil treatment alone except where Phinotas oil was used. To date there have been very few treatments in Connecticut with other materials, and too little time has elapsed since treatment to show any results. As soon as any reliable information is obtained, it will be published.

Re-examination of 21 completely shielded buildings showed no case in which termites had come from the ground up over the shield to reinfest the building. In two cases termites dropped tubes *down over* shields soon after installation. Several shields did not comply with specifications in every way, but were effective in stopping the termites. One "shield," incorrectly installed, was of no value (Case No. 3). The only possible conclusion that can be drawn from this series of studies is that properly installed metal termite shields have proved to be effective in actual practice in Connecticut.

The cases involving partial shielding or use of structural methods other than shielding, either with or without soil treatment, showed the expected results. Termites did not enter the buildings over partial shields and in some cases have not appeared in the buildings since the work was done. In other cases the use of minor changes with soil treatment was unsatisfactory.

The four cases in which timbers in place were impregnated and soil treatment used showed: (a) That the thoroughness of the treatment varied; (b) that the companies attempted to control termites under difficult conditions and apparently failed, and (c) that operators did not follow specifications in regard to the necessary structural changes. Neither these facts nor those cited in the miscellaneous cases are meant to be a general indictment of chemical treatments. There is insufficient evidence as yet to prove or disprove the claims regarding such treatments. Moreover, the only evidence accumulated in regard to soil treatments is that Phinotas oil has not been effective in actual practice. To date experience has borne out statements made previously that listed the limitations of such treatments (6).

Hazards of Termite Treatments

In a previous publication (6) attention was called to the possibility that soluble arsenicals used in soil treatment might poison wells and

streams. A home owner on his own initiative recently treated the soil around the porch piers and adjoining the foundation with creosote. A few weeks later heavy rains occurred and in some way the creosote was carried into a 190-foot well which had been drilled and cased. The water was unfit for use for several days. There are definite reports that a well in western Connecticut has been polluted by arsenic used in soil treatments, but to date the writers have been unable to confirm the reports. Several operators know about the case but refuse to divulge any information regarding it.

Attention was also directed to fire hazards (6). In the summer of 1937 an explosion occurred under a house in Terre Haute, Ind., following application of an inflammable material used to control termites. An electric light bulb on an extension cord was broken and the flash ignited fumes from the treating material. The termite control operator and the eight-year-old son of the occupant of the house were killed. Several years ago an explosion and minor fire followed the use of carbon bisulphide in a trench around a house in Connecticut. This material was used to kill termites in the soil. The explosion was caused by a spark appearing when a workman struck a rock with a pick. If inflammable or explosive materials are used in termite work, operators must exercise every care to prevent explosions. It would be desirable to avoid the use of such materials.

LITERATURE CITED

1. Fuller, C. First Report of the Government Entomologist, 1899–1900. Natal Dept. Agr. 1901. (White ants, pp. 84–86).
2. Froggatt, W. W. White Ants. Dept. Agr. New South Wales. Misc. Pub. 874. 1905.
3. ———— White Ants. Dept. Agr. New South Wales. Farmers' Bul. 60. 1913.
4. Howard, L. O. History of Applied Entomology. Smithsonian Miscellaneous Collections, Vol. 84. 1930. (p. 396).
5. Jack, R. W. Termites or "White Ants". Dept. Agr. Rhodesia, Bul. 139, 1913. (Abstract in Rev. Appl. Ent. 1: 464–466. 1913).
6. Turner, N. and Townsend, J. F. Termite Control in Buildings in Connecticut. Conn. Agr. Exp. Sta. Bul. 382. 1936.
7. Turner, N., Zappe, M. P. & Townsend, J. F. Observations on Termites and Termite Control. In Conn. Agr. Exp. Sta. Bul. 396. 1937.

CONTROL OF ONION THRIPS

Neely Turner

Onion thrips, *Thrips tabaci* Linde, were more abundant and destructive during 1937 than for several years past. Control tests were made on both set and seed onions in commercial fields. All sprays were applied with a spraying attachment on a garden tractor. (See Figure 16.) In the first experiment pure ground cubé root was used at the rate of one pound in 25 gallons (1) with *Ultrawet*, 1-800, (2) with *Ultrawet*, 1-1600, (3) with *Aresket*, 1-1600 and (4) with no spreader. These treatments were compared with nicotine sulfate, 1-800 (1) with *Ultrawet*, 1-1200 and (2) with *Aresket*, 1-1600.

Figure 16. Spraying onion plants to control onion thrips.

Three treatments, June 16, 25 and July 1, kept the thrips population low, but downy mildew killed the plants prematurely and there was no effect on yield. However, the tests showed (1) that cubé was more effective than nicotine sulfate, (2) that the addition of a spreader increased the effectiveness of cubé, (3) that *Ultrawet* was as effective as *Aresket* and (4) that *Ultrawet*, at 1-1600, was more effective than at 1-800. The second test was made on set onions heavily infested (500 thrips per plant). The materials were (1) pure ground cubé root, one pound in 25 gallons of water, (2) cubé plus *Ultrawet*, 1-1600, (3) cubé plus 4 pounds sulfur plus *Ultrawet*, 1-1600 and (4) 4 pounds sulfur plus *Ultrawet*, 1-1600. Two applications were made, July 8 and 16, before downy mildew killed the onions. The cubé-*Ultrawet* was most effective. The addition of sulfur increased the effectiveness in hot weather but reduced it in cool weather.

The third test was made on seed onions lightly infested when the first spray was applied. Dates of spraying were July 16, 23, 30 and August 6. The materials were cubé-*Ultrawet* and cubé-sulfur-*Ultrawet*. The four applications of cubé-*Ultrawet* kept the population low all season;

final count 24 per plant. The addition of sulfur did not increase the effectiveness. The sprayed onions yielded more than 100 bushels per acre above the untreated plots.

EUROPEAN RED MITE CONTROL INVESTIGATIONS, 1937

Philip Garman

Our investigations this year consisted of developing suitable schedules using sprays with a minimum of sulfur. This work included leaf and twig counts by Mr. Townsend and observations in orchards where outbreaks have occurred. Results have been interesting to us for a number of reasons.

The two orchards in which detailed work was carried on included one of S. R. MacDonald in Wallingford and the Graham orchard in Lebanon. In neither of these orchards was there an extensive outbreak of European red mites, but they did become abundant in a Delicious and McIntosh block in Wallingford. These blocks received a full schedule of lime sulfur without dormant oil. Two Baldwin plots in this same orchard were studied and compared, one receiving no dormant oil and the only sulfur spray being lime sulfur at the pink stage with lime-lead arsenate the rest of the season; the other receiving oil with the same schedule following except for soap and nicotine at the prepink stage. There was no outbreak in either of these plots, and an egg count at the end of the season showed only a slight difference in red mite abundance, namely, a ratio of three to five in favor of the block receiving no oil. The build-up of mite enemies in the two plots was about the same. In the Delicious plot receiving a full schedule of sulfur, there was a four- to seven-fold increase of red mite eggs over the number in the two blocks just mentioned.

In the Graham Lebanon orchard, no outbreak occurred, but twig counts after the leaves were off again revealed a decided difference in red mite winter eggs in the following order:

1.	Plot receiving no oil or sulfur	1
2.	Plots (2) receiving oil followed by flotation sulfur	14 to 29
3.	Plot receiving no oil but sprayed with lime sulfur to calyx	60

Further observations of red mite enemies were made in Wallingford, Guilford, and Bantam where outbreaks occurred, and the results are shown in Table 13. It will be noted from Table 13 that wherever sulfur sprays were applied a marked reduction in predators resulted. Only two exceptions were seen in eight orchards examined.

Continued study of mite enemy hibernating quarters indicated that three of the more important ones winter on the bark of the larger branches and trunk. They become active about the first of May and move onto the foliage as soon as the leaves are large enough to receive them. Seius species seem to continue in abundance throughout the summer, but Scolothrips were more active in spring than at other periods. The ladybeetle, *Stethorus punctum*, is more abundant in late summer. In a series of tests at Westwoods, thrips were removed almost completely by sprays of tar oils but were not seriously depleted by two other oils.

So far the work in commercial orchards has not progressed far enough to warrant conclusions regarding the success of the reduced sulfur spray schedules employed. Observations, however, in general show the need of fungicides up to and possibly including the calyx, but as indicated by Zappe and Stoddard, the lime, lead arsenate and fish oil schedule may be all that is needed for non-scabbing varieties in favorable locations. Scab did not amount to more than 5 percent in any of the commercial Baldwin plots receiving lime, lead arsenate and fish oil this year. There was, however, leaf spot and drop on some of the trees, which might have been corrected by early fungicide sprays. The past year was one of the worst for apple diseases in recent times.

TABLE 13. EUROPEAN RED MITE ENEMY ABUNDANCE, 1937

Orchard	Treatments	Seius per 100 leaves	Date
C.A.E.S., Mt. Carmel	Flotation sulfur	1	June 19
	No sulfur	45	June 19
	None	60	June 19
C.A.E.S., Mt. Carmel	Flotation sulfur	0	Sept. 15
	No sulfur	61	Sept. 15
MacDonald, Wallingford	Sulfur at pink only No dormant oil	22	Sept. 11
	Sulfur at pink only Dormant oil	28	Sept. 11
*	Lime sulfur No dormant oil	11	Sept. 1-9
Townsend, Westwoods	Lime sulfur No dormant oil	2	Sept. 27
	No sulfur Dormant oil	15	Sept. 27
Graham, Lebanon	Sulfur Dormant oil	0	Aug. 7
	No sulfur No dormant oil	30	Aug. 7
*Curtis, Bantam	Sulfur. Leaves from center of outbreak	2	Sept. 18
	'No sulfur since calyx'	35	Sept. 18
*Kneuer, Guilford	Sulfur. Leaves from center of outbreak	3	Sept. 17
	'No sulfur'	155	Sept. 17

* Noticeable bronzing of foliage.

Two orchards investigated showed no increase in red mite enemy abundance following omission of sulfur. In all three outbreaks investigated this year, Seius populations were scarce or absent.

CURCULIO CONTROL ON PEACHES

PHILIP GARMAN

Tests were conducted during the season with control of the plum curculio by means of sprays, employing cryolite, in comparison with basic zinc arsenate and lead arsenate. The results obtained and summarized in Table 14 indicate that cryolite and lead arsenate afforded the best control of curculios developing in the fruit. Similar results were obtained in 1933 using barium fluosilicate and dry wettable sulfur (see Bul. 360, p. 455) and in 1936 with natural cryolite and dry wettable sulfur. Our results in 1936, not hitherto published, showed a total of 36 percent infested drops in the cryolite plots, 33 percent in the plots treated with standard acid lead arsenate and zinc sulfate and 70 percent from trees receiving no poison.

This year both basic zinc arsenate with lime, and zinc sulfate as well as cryolite with lime, flotation sulfur paste and fish oil sticker caused severe foliage burn and drop, but the trees sprayed with natural cryolite recovered promptly and bore a fair crop of fruit in spite of defoliation. Injury from the cryolite combination was attributed to various causes such as combination with lime and flotation sulfur paste or the addition of fish oil, but later sprays with these combinations on a smaller scale, applied with a hand sprayer, failed to produce similar results. Injury in 1936 resulted from a mixture of flotation sulfur paste, cryolite and skim milk so the oil may possibly be eliminated as a cause. In tests where it has been used with flotation sulfur paste, injury occurred both in 1935 and 1937 whereas in all sprays during 1933, 1936 and 1937, wherever barium fluosilicate or natural cryolite was used with a dry wettable sulfur, injury to the foliage was negligible.

TABLE 14. CURCULIO CONTROL ON PEACHES—SUMMARY OF DROP COUNT, 1937

Treatment	No. trees examined	No. fruits examined	Percentage with curculio	Range in percent infested
Check—no treatment	6	4,019	50.5	35–81
Basic zinc arsenate	6	1,755	48.5	34–90
Lead arsenate	4	2,544	24.0	7–54
Natural cryolite	5	2,813	11.0	8–20

Sprays applied May 27–29 and June 12

Formulae used in 100 gallons

1.	Basic zinc arsenate	3 lbs.
	Lime (hydrated)	3 lbs.
	Zinc sulfate	1 lb.
	Flotation sulfur paste	10 lbs.
2.	Lead arsenate	2 lbs. first spray 3 lbs. second spray
	Zinc sulfate	4 lbs. }
	Lime (hydrated)	6 lbs. } both sprays
	Flotation sulfur paste	10 lbs. }
3.	Natural cryolite	4 lbs. first spray
	Lime (hydrated)	2 lbs.
	Flotation sulfur paste	10 lbs.
	Fish oil	1 pint
	Natural cryolite	4 lbs. second spray
	Lime (hydrated)	2 lbs.
	"Magnetic wettable sulfur"	5 lbs.
	Casein waterproof glue	¼ lb.

ORIENTAL FRUIT MOTH PARASITE WORK, 1937

PHILIP GARMAN

Parasite breeding was continued by Messrs. Brigham, Schread and Smith throughout the fall of 1936 and winter of 1937. Owing to elimination of grain moths in our reserve room during the fall by the mite, *Pediculoides ventricosus* Newp., we were faced by a shortage of material with which to stock the main breeding room. This shortage was remedied in part by importation of grain moth eggs from California and we were able to produce 7,010,000 Trichogramma parasites for distribution to Connecticut growers. Four other parasites were bred and liberated as follows: *Bassus diversus* Mues., 27,380, *Macrocentrus ancylivorus* Rohwer, 20,208, *Phaeogenes haeussleri* Cush., 7,673, *Dioctes molestae* Uch., 6,137, and *Orgilus longiceps* Mues., 391.

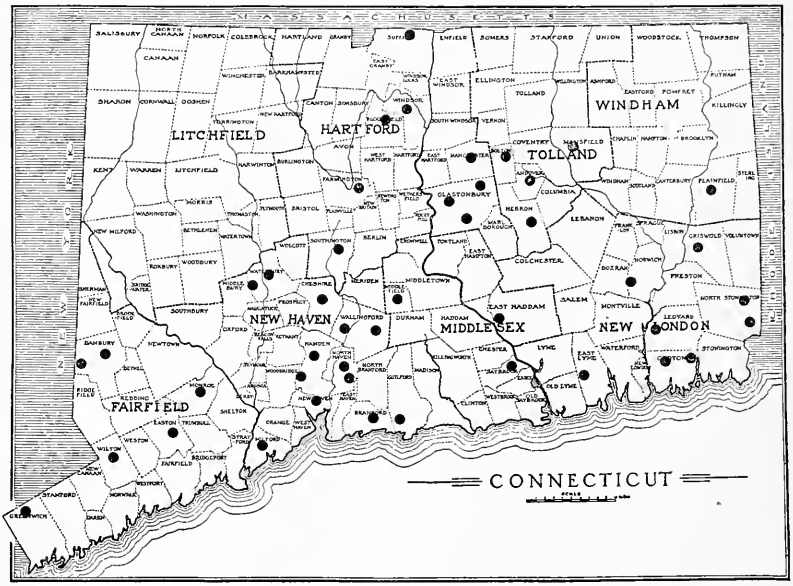

FIGURE 17. Map of Connecticut showing localities where *Bassus diversus* has been liberated.

The total larval parasites placed in Connecticut was 61,789 or about twice the number liberated in 1936. In addition to the number reared for Connecticut, 12,540 Macrocentrus were sent to Massachusetts at the request of Massachusetts growers and Experiment Station authorities. Mr. DeCaprio was sent to New Jersey where he collected strawberry leaf roller larvae which were shipped to New Haven. The adult Macrocentrus parasites were reared in our laboratory and the adults sent on to Massachusetts. Mr. P. H. Marvin handled shipments of rolled strawberry leaves arriving in New Haven and helped in other ways.

The distribution of several newly imported species of fruit moth parasites is shown in Figures 17 to 20.

An extensive program of recovery was carried out during the summer by Messrs. Schread, Smith and DeCaprio with interesting results.

Recoveries of Larval Parasites

One of the newer larval parasites, *Dioctes molestae*, was recovered at five different points under conditions which showed that it had passed the winter successfully. *Bassus diversus* was recovered from a number of localities but there is no evidence that it survived the winter. In addition, Mr. Smith made a number of band collections in three different orchards in the center of the State. The results are shown in Table 15. It will be

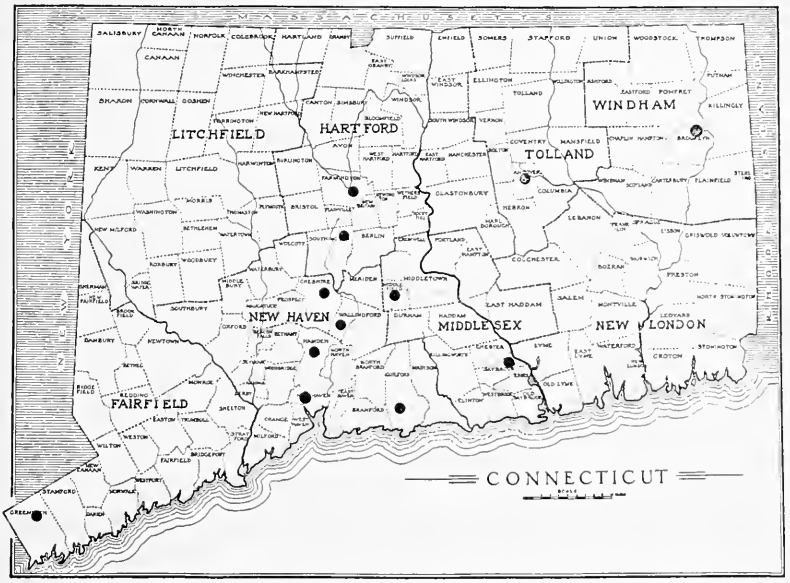

FIGURE 18. Map of Connecticut showing localities where *Phaeogenes haeussleri* has been liberated.

seen that *Macrocentrus ancylivorus* is still the most abundant larval parasite in these orchards. The appearance of *Dibrachys boucheanus* Ratz., a secondary parasite, in considerable numbers may explain in part the general scarcity of larval parasites during 1936 and 1937. Dibrachys is known to be both primary and secondary in its habits but whether it has much direct action on fruit moth larvae in the field is not known. Our laboratory experience with it a few years ago (Bul. 360, p. 476) indicated that it could be a very effective primary parasite. The remaining parasites reported in the table are not all enemies of the fruit moth. There are also several secondaries besides Dibrachys but they appear in relatively small numbers. Both *Bassus diversus* and *Dioctes molestae* were taken in these collections under conditions which would indicate a tendency to hibernate in the larvae of the fruit moth. Recoveries of Dioctes from a young orchard in Milford indicated also that it increases rapidly immediately following liberation. Here a liberation of 200 females on June 30 in an orchard of about two acres resulted in a parasitism by this species of 11 percent on July 7, 51 percent on July 14 and 39 percent on July 21. Collections on June 30 gave no Dioctes because none had been liberated in the orchard previous to that time.

TABLE 15. ORIENTAL FRUIT MOTH PARASITES, 1937
SUMMARY OF BAND COLLECTIONS FROM PEACH ORCHARDS[1]

Parasite	Number collected	Percent of total
Macrocentrus ancylivorus Rohw.	159	48.4
Dibrachys boucheanus Ratz.	61	18.5
Agrotheureutes hyslopi Viereck	22	6.7
Glypta rufiscutellaris Cress.	20	6.1
Isadelphus smithii Pack.	14	4.2
Copidosoma sp.	12	3.6
Eurytoma sp.	10	3.0
Bassus diversus Mues.	8	2.4
Otacustes sp.	6	1.8
Eubadizon pleurale Cress.	4	1.2
	316	
Scambus pterelas Say	2	
Dioctes molestae Uch.	1	
Ephialtes aequalis (Prov.)	1	
Campoplex sp.	1	
Epyris sp.	1	
Gonatopus sp.	1	
Apterophygus sp.	1	
Eupelmus momphae Gahan	1	
Scambus sp.	1	
Sagaritis sp.	1	
Terobia sp.	1	
	12	3.6

[1] All identifications by J. C. Schread.

Recoveries of larval parasites were attempted from a total of 27 orchards throughout the State, the work being carried on by Messrs. Schread, Brigham, Smith and DeCaprio. Table 15 giving representative collections indicates that Macrocentrus is appearing in larger numbers than last year, but that all parasites were scarce in June in spite of a mild winter in 1936 and 1937. During the season, egg collections for Trichogramma parasitism were also made by Messrs. Schread and DeCaprio. These collections covered 18 orchards. The average larval parasitism in the 27 orchards examined was 20.2 percent while the average egg parasitism in the 18 orchards covered in the survey was 18.9 percent.

At the end of the season sample collections of peaches were made from the orchards studied with a view to discovering if possible what relation the degree of parasitism has to the amount of wormy fruit. Assembling the parasitism during July and placing opposite the amount of infested fruit obtained at the close of the season we obtain results given in Table 16.

TABLE 16. EFFECT OF JULY LARVAL PARASITISM ON AMOUNT OF INFESTED FRUIT

Orchard	Larval parasitism in July	Percent of fruit infested	
1	0	40.5	32.1
2	3.4	27.0	
3	26.4	16.9	23.2
4	37.5	26.4	
5	52.9	26.4	
7	60.0	16.0	10.5
8	85.7	5.0	

These show a general correlation between the amount of larval parasites recovered in July and the percentage of infested fruit. With regard to egg parasitism the results are not quite so clear, but it is believed that in order to obtain a true picture of parasitism in relation to the final infestation, consideration of egg, larval and pupal parasitism is necessary.

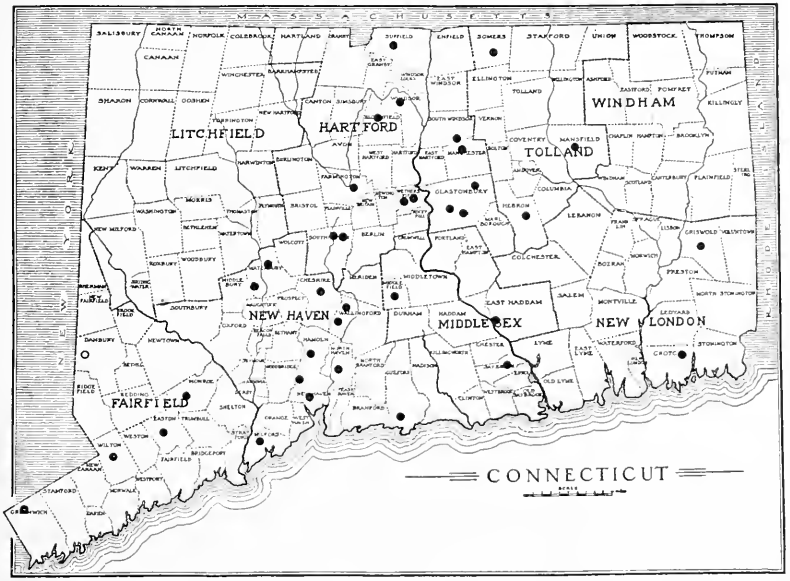

FIGURE 19. Map of Connecticut showing where *Dioctes molestae* has been liberated.

Table 17 shows the egg parasitism in orchards where comparable collections were made and as in the preceding table the percentage of infested fruit at harvest is opposite. Figures for egg parasitism are given for both July and August.

TABLE 17. EFFECT OF EGG PARASITISM ON AMOUNT OF INFESTED FRUIT

Orchard	Collection dates	Average percent eggs parasitized	Percent of fruit infested
A	July 16–20	36	25.0
B	July 23–24	28	5.1
C	July 21–22	41	16.0
D	July 26	2.5	40.5
C	Aug. 3, 20	5.5	16.0
E	Aug. 12	14.7	26.4
D	Aug. 2, 19	14.5	40.5
F	Aug. 12	1.6	37.5 (Est.)

It is evident from this record as well as other figures not reported here that parasitism by Trichogramma was very much reduced during August as compared with July. This was probably due to heavy rainfall which, according to Weather Bureau records, was nearly twice that of a normal season. It is quite possible that liberations during July raised the total

parasitism during that month, but whatever parasitism was secured was evidently nullified by heavy rains in August. The parasitism by Macrocentrus on the other hand during July would naturally be reflected in the amount of fruit infestation because it would affect the size of the third generation entering the fruit.

Collection of fruit moth eggs from orchards where Trichogramma had been liberated this year, as compared with those in which no liberations were made, gave no significant increase over untreated orchards. Comparison, however, is difficult because of the fact that not all collections were made at the same time. In the case of Macrocentrus there appeared to be some increase in parasitism wherever parasites were liberated during the last two years, but the increase is not great and this leads us to suspect that secondary parasites as well as the unfavorable season may be influencing development of this parasite (Table 18).

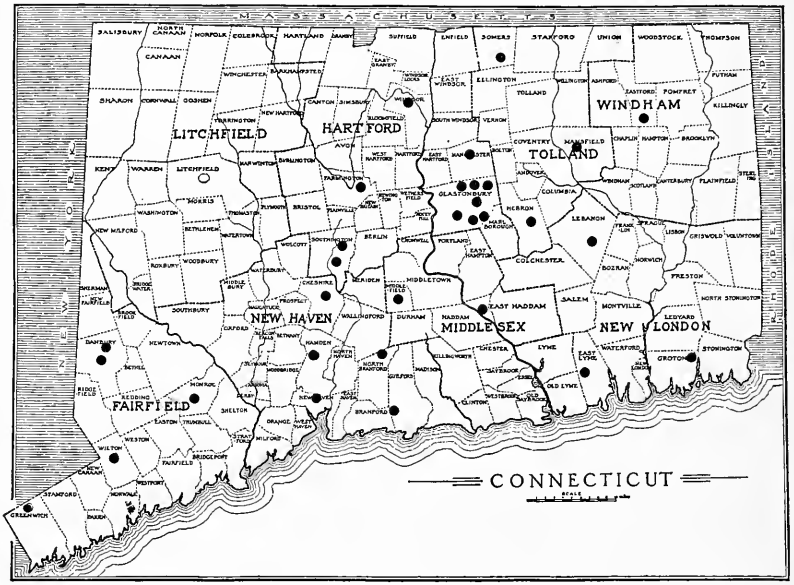

FIGURE 20. Map of Connecticut showing where *Perisierola angulata* has been liberated.

TABLE 18. MACROCENTRUS RECOVERIES, 1937.

Orchard and location	Date	Productive tips collected[1]	Macrocentrus recovered	Percent parasitized by Macrocentrus
No liberations during the last two years				
Shepard—Danbury	June 11	38	0	
Spicer—Deep River	June 13	38	1	
Conyers—Greenwich	June 15	68	0	
Shiffrin—Milford	June 23	20	0	

[1] Either moths or parasites reared.

TABLE 18—*Continued*

Orchard and location	Date	Productive tips collected[1]	Macrocentrus recovered	Percent parasitized by Macrocentrus
Shiffrin—Milford	July 10	19	0	
Shiffrin—Milford	July 21	23	0	
College—Storrs	July 14	54	0	
College—Storrs	Aug. 19–25	45	11	
Expt. Sta.—Mt. Carmel	July 16	29	1	
Coolac—Branford	July 24	22	4	
		356	17	4.7
Macrocentrus liberations during 1936 and 1937				
Swanson—Mill Plain	June 11	17	0	
Whittle—Mystic	June 13	24	0	
Sonozzaro—North Haven	July 17	9	4	
Root—Farmington	June 12	43	5	
Lyman—Middlefield	June 19	4	0	
Lyman—Middlefield	July 17	7	0	
Lyman—Middlefield	July 24	34	5	
Bishop—Cheshire	July 7	7	1	
Bishop—Cheshire	July 21	5	2	
Rogers—Southington	July 21, 24	29	4	
		179	21	11.7

[1] Either moths or parasites reared.

EXPERIMENTS WITH SPRAY CONTROLS FOR THE ORIENTAL FRUIT MOTH

PHILIP GARMAN

About two-thirds of the Experiment Station peach orchard at Mount Carmel was divided into 16 plots of 9 trees each arranged in a latin square. Three different insecticides were used on 12 of the plots and the rest were left untreated. Sprayed plots were treated three times during August with a power sprayer, covering fruit and foliage as thoroughly as possible. At harvest more than 9,000 peaches were cut open and, wherever the total crop was small, all picked fruit was handled in the same way. In cases where the quantity of peaches was too large to obtain the needed information in the short working time available, every fifth peach was taken from the baskets as they were counted. These were then cut open and the percentage infested applied to the picked fruit as a whole.

Spray applications were made on August 5, 14 and 28. Materials were as follows:

Plot (1) Ground cubé root, 4 pounds to 100 gallons of water.

Plot (2) Ground cubé root, 4 pounds to 100 gallons of water plus Ultrawet[1] spreader, ¼ to ¾ pound to 100 gallons.

Plot (3) Fixed nicotine made with Quebracho tannin, the stock containing 4.35 percent nicotine, 10 pounds in first spray, 12 pounds in second and third applications.

Plot (4) Check—no sprays during August.

[1] Sodium salt of water soluble sulfonic acids made by acid-treating petroleum.

TABLE 19

Materials	Plots	Total fruits	Injured or infested by fruit moth	Percent infested
Cubé, 4 lbs.—100 gals.	1	2,546	677	26
	2	1,205	187	15
	3	1,126	401	34
	4	918	564	61
		5,795	1,829	31.3
Cubé, 4 lbs.—100 gals. plus Ultrawet	1	1,641	466	28
	2	1,111	299	26
	3	1,297	271	20
	4	1,293	464	35
		5,342	1,500	28.0
Quebracho-nicotine 10–12 lbs.—100 gals.	1	983	156	15
	2	2,258	423	18
	3	1,144	457	39
	4	1,057	245	23
		5,442	1,281	23.5
Check—no treatment	1	1,012	289	28
	2	2,091	537	25
	3	788	115	14
	4	1,247	374	30
		5,138	1,315	25.5

It will be seen from the figures presented that there was no significant difference in the amount of infested or injured fruit from any of the treatments. Separation of the types of injured fruit into old and new did not afford any more favorable data as regards sprays.

OBSERVATIONS ON TRICHOGRAMMA IN CONNECTICUT PEACH ORCHARDS, 1935

GEORGE R. SMITH AND PHILIP GARMAN

Trichogramma parasites have been released in large quantities since 1929 in Connecticut. The effect of these parasites upon the reduction of the Oriental fruit moth has been noticeable under some conditions but there has always been a question as to their ability to survive the winter. Therefore, after the severe cold of 1933–1934 and 1934–1935, it was decided to check on the number of Trichogramma parasites left in orchards of southern Connecticut. None of the orchards selected for these tests had been colonized with Trichogramma during 1935 up to the time when this work started on May 29.

The first tests at Mount Carmel consisted of 15 cards containing grain moth eggs hung systematically throughout the orchard. Two days later, the cards were collected for examination. Seven live female Trichogramma were found on them. These were mounted on slides and examination showed that they were considerably larger and darker than those reared

under laboratory conditions. The fact that they were larger as well as the fact that no parasites had been released in this orchard since 1933 seemed to indicate survival. The exposed cards all showed signs of parasitism by Trichogramma after four days. Average temperature and humidity at Mount Carmel was 77 and 54 percent at the time cards were in the field.

Similar cards were distributed in two of the Bishop orchards in Cheshire on May 31, 1935. The following day was rainy. On June 3, the cards were collected and active parasites were found in both orchards used for the test. A shuck fall spray was applied during the time the cards were in the orchard, but a fair percentage of parasitism developed after removal from the field. Whatever reduction occurred might have been due either to the rain or to the shuck spray (Kolofog and lead arsenate). Again, adults were seen to be actively at work at the time of collection.

Cards were next placed in two orchards owned by N. Kneuer and Sons at Guilford, and one orchard of C. O. Young and Sons, North Branford. Rainy and chilly weather prevailed while the first set of cards were in the orchards and they were replaced by a second lot. Cards from the first exposure gave evidence that parasites had been at work despite unsuitable weather conditions. Adult parasites were seen on the cards at Kneuer's but not at Young's. The replicate experiment gave practically the same results with the exception of the cards returned from Kneuer's where a shuck spray was applied during the time they were in the orchard. Here parasitism of the eggs was somewhat reduced.

The last test was at Stepney in the orchard of Ralph Benedict. No parasites had been released there since 1933 and this orchard afforded a duplicate set of conditions to those occurring in the Experiment Station orchard at Mount Carmel. Cards were placed in the trees on June 14, and collected on June 17 with ideal weather during the time they were out. No adult parasites were seen on the cards at the time of collection but on examination later a few parasitized eggs were found on some of them. The explanation for this result under ideal conditions may be that the quantity of parasites released there in 1933 was below that released at the Experiment Station orchard, or that other conditions were not favorable. However, the results proved that the parasites were established and had been able to survive the cold weather. From the observations reported it will be seen that:

1. Trichogramma presence was easily demonstrated in an orchard by means of unparasitized grain moth egg cards hung in the trees.

2. Trichogramma will survive cold winters in Connecticut and may come through in fairly large numbers.

3. Spraying tends to retard the activity of the female but one spray does not necessarily eliminate the parasites. In some of the tests good parasitism was secured in spite of sprays.

Table 20 gives the actual figures obtained covering the data on which the above observations are based.

TABLE 20. RECORD OF TRICHOGRAMMA COLLECTIONS FROM GRAIN MOTH EGG CARDS HUNG IN SOUTHERN CONNECTICUT PEACH ORCHARDS, 1935

Orchard and location	Number of cards	Days exposed	No. live adults on cards	Percentage of cards showing parasitism	Average Temperature	Dates	Notes
Expt. Station-Mount Carmel	15	2	7	100	77	5/29–31	
Bishop-Cheshire	10	3	19	100	70	5/31–6/3	Sprayed
Bishop-Cheshire	10	3	9	100	70	5/31–6/3	Sprayed
Kneuer-Guilford (N)	7	3	1	86	61	6/4–7	
Kneuer-Guilford (S)	7	3	2	57	61	6/4–7	Sprayed
Kneuer-Guilford 2nd (N)	7	4	0	57	66	6/7–11	
Kneuer-Guilford 2nd (S)	7	4	1	43	66	6/7–11	
Young-N. Branford	6	3	0	50	61	6/4–7	
Young-N. Branford 2nd	6	4	0	33	66	6/7–11	
Benedict-Stepney	7	3	0	71	80	6/14–17	

FURTHER STUDIES ON APPLE MAGGOT CONTROL

PHILIP GARMAN AND J. F. TOWNSEND

As indicated on page 379, Bulletin 396 of this Station, .75 percent rotenone dust was more effective than lead arsenate for killing apple maggot flies in cage tests. During 1937, experiments were continued using .5 percent rotenone dust, which was likewise found to be effective. It was decided to carry the work on in field investigations in order to learn what could be expected of these dusts under orchard conditions.

Two plots, one at Mount Carmel and the other in Westwoods, were each dusted three times using .5 percent rotenone dust in a clay carrier, this treatment following a lime, lead arsenate and fish oil schedule which was completed the middle of June. Examination of the fruit at harvest by sampling and cutting indicated that we had the best maggot control for a number of years. The results of the last three years are shown in Table 21.

TABLE 21. CONTROL OF APPLE MAGGOT. EXPERIMENT STATION FARM, MOUNT CARMEL. 1935–1937 PERCENTAGE INFESTED FRUITS

Variety	1935	1936	1937
Wealthy	34.6	n.c.	.6
Hurlbut	4.9	40.6	3.8
Greening	.8	27.4	.8
Greening, checks	43.2	58.2	n.c.
Mother	8.2	21.2	1.6
Mother, check	85.7	67.9	27.9

n.c. No crop.
Spray 1935. Lead arsenate or cryolite with fungicide.
Sprays 1936. Calcium arsenate or lead arsenate.
Sprays 1937. Lime, lead arsenate, and fish oil or flotation sulfur and lead arsenate to middle of June. Three .5% rotenone dusts in July.

At the Westwoods orchard, Cortlands were treated the same as at Mount Carmel and averaged 14 percent infested at harvest with checks showing 51 percent.

In connection with laboratory tests, it became apparent that exposure to light and wetting down the dust and using it as a spray destroyed its efficiency.

TABLE 22. APPLE MAGGOT CONTROL.
LABORATORY, 1937

Treatment	Exposure in greenhouse	Percent mortality 20 days	Egg punctures per female 20 days
.5% rotenone dust	2 days	66	16
.5% rotenone dust	5 days	12	38
.5% rotenone dust	5 days	5	44
.5% rotenone dust	6 days protected from light	100	0
.5% rotenone dust	6 days protected from light	100	0
.5% rotenone dust	Fresh dust—no exposure	100	0
.5% rotenone dust	Fresh dust—no exposure	87	0.5
.5% rotenone dust	Fresh dust plus 5% oil	100	0
Check—no treatment	——	29	47

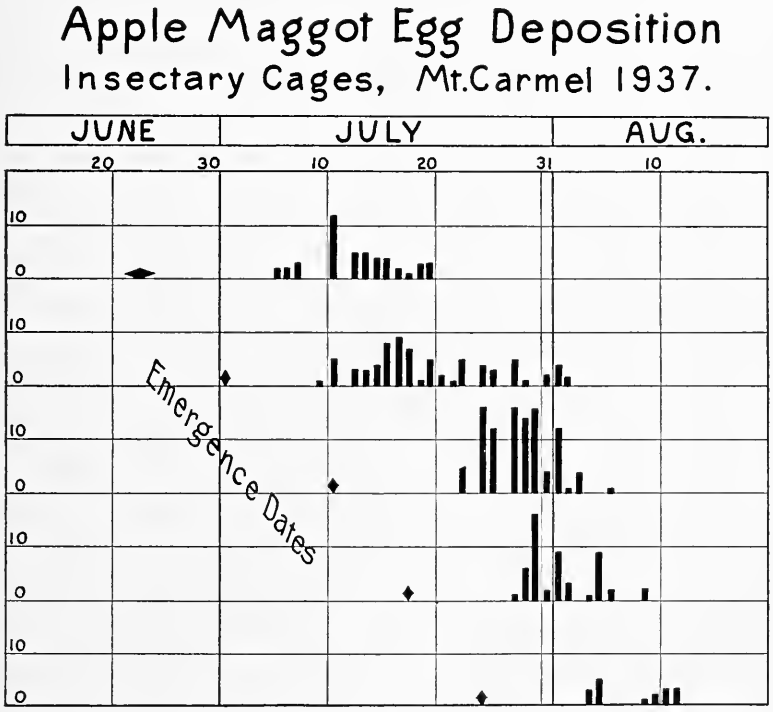

FIGURE 21. Chart showing emergence dates and egg deposition of the apple maggot.

It will be seen from Table 22 that exposure to light under greenhouse conditions destroyed the insecticidal action of rotenone dust completely in five days. In view of these findings, an effort was made to apply dusts

in our field experiments after rainy periods rather than before, and to dust from all sides of the tree in order to get the dust well within the tree where it would be protected from light. Observations on the Mount Carmel orchard indicated that flies were eliminated in spite of the fact that infested Gravenstein drops from another orchard were dumped under the trees during the fall of 1936. At the Westwoods orchard, elimination of flies likewise appeared to be complete.

Flies were obtained from ground cages in the Mount Carmel orchard and continuous records of egg deposition were kept by Mr. Townsend. These figures, illustrated graphically in Figure 21, indicate that egg laying commences in about 10 days and that egg deposition continues for three weeks or more, the maximum being reached usually between two and three weeks after emergence. This would mean that flies emerging July 20 (frequently the peak of emergence) will be laying most of their eggs about August 7–10, so that should flies come into the orchard from outside sources at that time there would be ample opportunity for infesting the fruit, particularly if the poison residues on the fruit or foliage are low. On this account there is probably a place for late applications of dust, such as rotenone dust, in order to destroy such flies as may come in at that time. The rapid destruction of the toxicity of derris dusts, however, indicates the need for a protective agent that will hold the toxicity for a longer period.

RESULTS OF TWO YEARS' FIELD EXPERIMENTS WITH STICKERS FOR DRY LIME SULFUR–LEAD ARSENATE SPRAY MIXTURES

PHILIP GARMAN AND C. E. SHEPARD

Discussion among entomologists and fruit growers regarding the value of some of the common stickers for standard spray mixtures led to the trial of a number available in 1936 for holding dry lime sulfur and standard acid lead arsenate on the foliage of apple trees. It will be realized that fish or other oil is not compatible with lime sulfur and was therefore omitted from the tests. Baldwin trees of moderate size (10 to 15 feet in height) were sprayed with a commercial power outfit using a quad nozzle and 400 to 450 pounds pressure at the pump. Sampling was done in the following manner: Four hundred to 800 discs were cut from each plot with a mechanical punch, the discs carefully counted and analyzed for arsenic by the bromate method. After a period of one to two weeks, samples were again taken from the plots, discs being cut from the same leaves as before though not as many because of the difficulty of locating all sampled leaves in any plot. Comparison of the two sets of analyses on the basis of $As_2 O_3$ per 100 discs provided data on which the percentage lost was computed.

Results of these experiments indicate that with only two of the stickers were there any great differences in loss of arsenic over trees receiving the standard treatment without sticker. Casein waterproof glue and Igepon-lead arsenate mixtures gave consistently better results than other stickers used. The commercial spreader reported is a modified casein flour mixture designed to build up the spray material on the foliage. This material showed up to a distinct disadvantage the first year, but appeared to be much better the second. Possibly the results with this particular product should be discounted until further tests are made.

As far as the arsenical deposit is concerned, there is relatively little difference in the rate of weathering between sprays with or without sticker, and even in the case of the more efficient, the differences after a period of rainfall appear to be not over 14 percent, and mostly less. It would appear, therefore, that variation in insect control due to such small differences would be difficult if not impossible to detect in field experiments.

The two materials showing consistent reduction in loss appeared to be as good or better than others in actual wetting properties. As to the amount of poison deposited, there seems to have been little or no advantage in any of the stickers over sprays where none was used.

TABLE 23

Sticker employed**	Dates	Rainfall in inches	Estimated percentage As_2O_3 lost	Rank in series*
Skim milk ½ lb.—100 gals.	5/20–6/5 1936	.26	58.2	4
	7/9 –7/16 1936	.63	75.2	6
	7/15–7/30 1937	1.61	58.0	4
	5/31–6/15 1937	.84	62.7	6
Casein glue ½ lb.—100 gals.	5/20–6/5 1936	.26	55.4	3
	7/9 –7/16 1936	.63	60.3	1
	7/15–7/30 1937	1.61	40.8	1
	5/31–6/15 1937	.84	57.2	5
Goulac ½ lb.—100 gals.	5/20–6/5 1936	.26	61.5	6
	7/9 –7/16 1936	.63	75.2	5
	7/15–7/30 1937	1.61	65.4	7
	5/31–6/15 1937	.85	56.4	4
Commercial spreader ¼ lb.—100 gals.	5/20–6/5 1936	.26	91.7	8
	7/9 –7/16 1936	.63	90.9	8
	7/15–7/30 1937	1.61	60.0	5
	5/31–6/15 1937	.84	51.9	2
Fish oil soap ¼ pint—100 gals.	5/20–6/5 1936	.26	60.9	5
	7/9 –7/16 1936	.63	75.9	7
	7/15–7/30 1937	1.61	61.0	6
	5/31–6/15 1937	.84	56.4	3
Sheep dip 3 pints—100 gals.	5/20–6/5 1936	.26	49.0	2
	7/9 –7/16 1936	.63	68.4	2
	7/15–7/30 1937	1.61	69.1	8
	5/31–6/15 1937	.84	65.2	8
Igepon lead arsenate No. 151	5/20–6/5 1936	.26	35.2	1
	7/9 –7/16 1936	.63	73.8	4
	7/15–7/20 1937	1.61	56.3	3
	5/31–6/15 1937	.81	50.6	1
Check—no sticker	5/20–6/5 1936	.26	78.4	7
	7/9 –7/16 1936	.63	71.2	3
	7/24–7/31 1937	1.32	50.1	2
	5/31–6/15 1937	.84	63.8	7

* Lowest amount of loss = 1. Next, 2, etc.

** Formula used: 6 lbs. dry lime sulfur, 3 lbs. acid lead arsenate in 100 gallons. One-half pound of each dry sticker except Igepon was added to each 100 gallons. The Igepon lead arsenate consisted of 10% Igepon and was used at the rate of 3.3 lbs. to 100 gallons.

In addition to the field experiments with stickers, considerable laboratory work has been done using 3.25 by 4.25 inch glass slides and a home-made device for washing which maintains a constant flow of water sprayed

onto the slides. Temperature of the wash water was adjusted to 25° ± 1° C., and the amount of water passing through the apparatus during the one-half minute period of washing was 600 cc. ± 5. Ten slides were used in each test and all slides were sprayed five times with a fine atomizer using the spray mixture and different stickers. An attempt was made to coat each slide with the same amount of material. After spraying and after washing, the slides were dried over calcium chloride for 24 hours or more before weighing. The results were analyzed statistically and the figures are presented in Table 24. No chemical analyses were made of the materials remaining on the slides.

The figures show that the casein waterproof glue is significantly better than the control (as regards total residue removed), which corroborates the results of our field experiments. Casein glue is likewise significantly better than either goulac or skim milk powder. The fish oil soap was used at twice the concentration employed in the field and in the slide tests it equalled the casein glue in adhesive properties, being significantly better than the control. It appeared somewhat more variable than the glue, however, which may have been due to the distribution of the spray on the slides and not to the sticker material. The check is not significantly better than either goulac or skim milk and only slightly worse than the two commercial spreaders. These facts also seem to be in accord with our field data.

In all cases, however, the differences are so small that it is doubtful whether they are of much practical value unless the margin of difference can be increased (by changes in composition or strength) over that shown in field and laboratory experiments.

In each test the 10 glass slides were sprayed with 6 grams of dry lime sulfur, 3 grams of lead arsenate and .5 gram of each of the stickers in 833 cc. water. Following is a description of the various products used as stickers.

Goulac: Lignin pitch or sulfite waste from paper manufacture, brown powder.

Skim milk: Low grade used for feeding purposes.

Commercial spreader No. 1: Casein, lime, bentonite, ferric sulfate mixture.

Commercial spreader No. 2: Clay, soap, oil mixture.

Casein glue: Brown powder, containing lime, casein, trisodium phosphate and possibly sodium fluoride. A commercial glue for general household use.

Fish oil soap: 30 percent potassium fish oil soap, neutral in reaction. Jam-like consistency.

TABLE 24

Sticker used	Average amount on each slide in hundredths gram	Percentage lost in washing
Goulac	9.83	79.1 ± 1.2*
Skim milk powder	11.43	76.1 ± 1.3
Check—no sticker	10.59	75.1 ± 1.2
Commercial spreader (1)	11.85	69.9 ± .5
Commercial spreader (2)	11.28	69.0 ± .4
Casein waterproof glue	9.69	64.5 ± .3
Commercial fish oil soap	11.45	64.3 ± 1.0

* Probable error of the mean.

CHECK LIST OF ELM INSECTS

B. J. Kaston

This compilation is an attempt to include in one list all insects (and mites) known to breed in or feed upon elms. Many of these have been well known for years; some have recently been collected or reared by the present author; while for others a reference to the authorities is included. To these latter and to Britton and Friend (1935) reference should be made for further details.

ISOPTERA

Termitidae

Reticulitermes flavipes Kollar. Occasionally in old stumps.

CORRODENTIA

Psocidae

Psocus moestus Hagen. (Pechuman, 1937).
Psocus slossonae Banks. (Pechuman, 1937).

Caeciliidae

Peripsocus madidus Hagen. (Pechuman, 1937).

Lepidopsocidae

Echmepteryx hageni Packard. (Pechuman, 1937).

HEMIPTERA

Tingitidae

Corythucha ulmi Osborn and Drake. Feeds on leaves.

Anthocoridae

Orius insidiosus Say. (Pechuman, 1937. A predator under bark).

Cicadidae

Magicicada septendecim Linnaeus. (Parks, 1936. Oviposits in twigs).

Membracidae

Ceresa bubalus Fabricius. Oviposits on twigs.

Aphididae

Longistigma caryae Harris. Twig aphid.
Myzocallis ulmifolii Monell. Occasionally on under side of leaves.
Colopha ulmicola Fitch. Forms cockscomb galls.
Eriosoma americana Riley. Rolls or curls one side of leaf.
Eriosoma lanigera Hausman. Forms leaf cluster, or rosette of leaves.
Eriosoma lanuginosa Hartig. Forms a pouch gall.
Eriosoma rileyi Thomas. Bark aphid.
Eriosoma ulmi Linnaeus. Forms leaf roll on European elm.
Pemphigus ulmifusus Walsh. (Felt, 1917. Slippery elm pouch gall).
Tetraneura graminis Monell. Forms cockscomb galls.
Tetraneura ulmisacculi Patch. (Felt, 1917. Forms sac gall).

COCCIDAE

Gossyparia spuria Modeer. Soft scale.
Phenacoccus dearnessi King. (Herrick, 1935. Mealybug).
Lecanium caryae Fitch. Occasionally on twigs.
Lecanium corni Bouché. Occasionally on twigs.
Chionaspis americana Johnson. On small twigs.
Aspidiotus ancylus Putnam. (Herrick, 1935).
Aspidiotus ulmi Johnson. On trunks and larger branches.
Lepidosaphes ulmi Linnaeus. Oyster shell scale.

LEPIDOPTERA

NEPTICULIDAE

Nepticula apicialbella Chambers. (Forbes, 1932. Makes a brown serpentine mine on upper side of leaf).
Nepticula ulmella Braun. (Forbes, 1923. Mines in leaves of cork and red elm).

EUCLEIDAE

Sisyrosea textula Herrick-Schaeffer. Occasional leaf feeder.

TINEIDAE

Oene hybromella Chambers. (Pechuman, 1937. Bred from wood).

PSYCHIDAE

Thyridopteryx ephemeraeformis Haworth. Occasional leaf feeder.

GRACILARIIDAE

Lithocolletis argentinotella Clemens. (Forbes, 1923. Makes a large tentiform mine on under side of leaf).
Lithocolletis occitanica Frey and Boll. (Forbes, 1923. Makes a tentiform mine on under side of leaf).
Lithocolletis ulmella Chambers. (Forbes, 1923. Makes a blotch mine on upper side of leaf).

COLEOPHORIDAE

Coleophora limosipennella Duponchel. Leaf miner. Elm case bearer.

ŒCOPHORIDAE

Schiffermuelleria argenticinctella Clemens. (Pechuman, 1937. Emerged from wood).

GELECHIIDAE

Helice constrictella Zeller. (Forbes, 1923. On leaves).

LAVERNIDAE

Perimede erransella Chambers. (Pechuman, 1937. Emerged from wood).

YPONOMEUTIDAE

Argyresthia undulatella Chambers. (Forbes, 1923. Bast miner on trunks and larger branches).

TORTRICIDAE

Anchylopera fuscociliana Clemens. (Forbes, 1923).
Cacoecia argyrospila Walker. Leaf roller.

COSSIDAE

Zeuzera pyrina Linnaeus. Leopard moth.

PYRALIDIDAE

Tetralopha asperatella Clemens. (Forbes, 1923).
Canarsia ulmiarrosorella Clemens. Feeds on leaves. Pupates in crevices of bark on trunks and larger limbs.

CITHERONIIDAE

Basilona imperialis Drury. Imperial moth. Occasional leaf feeder.

SATURNIIDAE

Automeris io Fabricius. Occasional leaf feeder.
Telea polyphemus Cramer. American silk worm moth. Occasional leaf feeder.

LASIOCAMPIDAE

Tolype velleda Stoll. Occasional leaf feeder.
Malacosoma disstria Hübner. Forest tent caterpillar. Occasionally on elm.

DREPANIDAE

Falcaria bilineata Packard. Occasionally on elm.

GEOMETRIDAE

Alsophila pometaria Harris. Fall canker worm.
Paleacrita vernata Peck. Spring canker worm.
Erannis tiliaria Harris. Lime-tree looper.
Ennomos subsignarius Hübner. Snow-white linden moth or elm spanworm.

SPHINGIDAE

Ceratomia amyntor Hübner. Four horned sphinx.

NOTODONTIDAE

Nerice bidentata Walker. Occasionally on leaves.
Schizura ipomoeae Doubleday. Occasionally on leaves.
Schizura unicornis Smith and Abbott. Occasionally on leaves.
Heterocampa bilineata Packard. Two-lined prominent. (Herrick, 1935).

LYMANTRIIDAE

Hemerocampa leucostigma Smith and Abbott. White-marked tussock moth.
Porthetria dispar Linnaeus. Gypsy moth.
Nygmia phaeorrhoea Donovan. Brown-tail moth.

NOCTUIDAE

Apatela morula Grote. Apple dagger moth. (Herrick, 1935).
Apatela vinnula Grote. Elm dagger moth. (Herrick, 1935).

ARCTIIDAE

Hyphantria cunea Drury. Fall webworm.
Halisidota caryae Harris. Hickory tussock moth.
Halisidota tessellaris Smith and Abbott. Tessellated tussock moth.

NYMPHALIDAE

Polygonia comma Harris. Hop merchant. (Herrick, 1935).
Polygonia interrogationis Fabricius. Violet tip.
Polygonia progne Cramer. Gray comma. (Herrick, 1935).
Hamadryas antiopa Linnaeus. Spiny elm caterpillar.

COLEOPTERA

Staphylinidae

Conosoma crassus Gravenhorst. (Pechuman, 1937. Under bark).
Conosoma opicus Say. (Pechuman, 1937. Under bark).

Histeridae

Platysoma coarctatum Leconte. Common in the galleries of bark beetles.
Platysoma depressum Leconte. Under bark.
Paromalus aequalis Say. (Pechuman, 1937. Under moist bark).
Isolomalus bistriatus Erichson. (Pechuman, 1937. Under moist bark).

Cleridae

Thanasimus dubius Fabricius. (Hopkins, 1893. Predator of *Hylurgopinus rufipes*).
Enoclerus nigripes Say. Very common predator of *Hylurgopinus rufipes*. Pupates in outer bark.
Hydnocera unifasciata Say. (Pechuman, 1937).
Zenodosus sanguineus Say. Uncommon.

Pyrochroidae

Dendroides bicolor Newman. Larvae in old loose bark.

Elateridae

Alaus oculatus Linnaeus. (Pechuman, 1937. Larvae occasionally in decaying logs).
Ludius rotundicollis Say. Larvae in loose bark.
Elater mixtus Herbst. Under loose bark.
Melanotus communis Gyllenhal. Common under loose bark.

Melasidae

Isorhipis ruficornis Say.

Buprestidae

Dicerca divaricata Say. Occasionally in elm.
Poecilonota cyanipes Say. Not uncommon.
Buprestis rufipes Olivier. Occasionally in elm.
Anthaxia viridicornis Say. (Pechuman, 1937. In smaller branches).
Chrysobothris femorata Olivier. Not uncommon.
Brachys aerosa Melsheimer. Leaf feeder on elm occasionally.

Ostomidae

Tenebroides bimaculatus Melsheimer. Larvae in old loose bark.
Tenebroides corticalis Melsheimer. Larvae in old loose bark.

Nitidulidae

Amphicrossus ciliatus Olivier.
Cryptarcha ampla Erichson.
Glischrochilus fasciatus Olivier.
Glischrochilus sanguinolentus Olivier.

Cucujidae

Silvanus bidentatus Fabricius. (Pechuman, 1937).
Cucujus clavipes Fabricius. Larvae in old loose bark.
Laemophloeus fasciatus Melsheimer.
Laemophloeus liquidus Casey. (Pechuman, 1937).

Colydiidae

Synchita fuliginosa Melsheimer. Larvae in old loose bark.
Eucicones marginalis Melsheimer. (Pechuman, 1937).
Bothrideres geminatus Say. (Pechuman, 1937).

TENEBRIONIDAE

Diaperis maculata Olivier. (Pechuman, 1937).
Alobates pennsylvanicus Linnaeus. Larvae in old loose bark.
Strongylium tenuicolle Say.

MELANDRYIDAE

Synchroa punctata Newman. Larvae very common in bark, associated with old tunnels of *Hylurgopinus rufipes*.

ANOBIIDAE

Hadrobregmus carinatus Say.
Ptilinus ruficornis Say. Bores in wood where bark is missing.

BOSTRICHIDAE

Endecatomus reticulatus Herbst.
Xylobiops basillare Say. (U.S.D.A. laboratory at Morristown, N. J.)
Lichenophanes armiger Leconte.

SCARABEIDAE

Phyllophaga spp. May beetles. Occasionally on elm.
Macrodactylus subspinosus Fabricius. Rose chafer. Occasionally on elm.
Popillia japonica Newman. Japanese beetle. Occasionally on elm.

CERAMBYCIDAE

Parandra brunnea Fabricius.
Asemum moestum Haldeman.
Hypermallus villosus Fabricius. Twig pruner.
Leptura mutabilis Newman.
Physocnemum brevilineum Say. Mines in outer bark.
Xylotrechus colonus Fabricius. Rustic borer.
Neoclytus acuminatus Fabricius. Common in large logs.
Neoclytus caprea Say.
Anthoboscus ruricola Olivier. (Pechuman, 1937).
Psenocerus supernotatus Say.
Psapharochrus quadrigibbus Say. (Pechuman, 1937).
Astylopsis macula Say. (Pechuman, 1937).
Leiopus variegatus Haldeman. (Pechuman, 1937).
Oncideres cingulata Say. Twig girdler.
Saperda lateralis Fabricius. (Herrick, 1935).
Saperda tridentata Olivier. Common elm borer.
Oberea tripunctata Swederus. Twig girdler.

CHRYSOMELIDAE

Monocesta coryli Say. (Baerg, 1935). Large elm leaf beetle.
Galerucella xanthomelaena Schrank. Elm leaf beetle.
Haltica ulmi Woods. Elm flea beetle.

BRENTIDAE

Eupsalis minuta Drury. (Herrick, 1935).

PLATYSTOMIDAE

Euparius marmoreus Olivier.

CURCULIONIDAE

Plocetes ulmi Leconte. Brown elm weevil.
Magdalis armicollis Say. Red elm weevil.
Magdalis barbita Say. Black elm weevil.
Magdalis inconspicua Horn. (U.S.D.A. laboratory at Morristown, N. J.)
Magdalis pandura Say. (Pechuman, 1937).
Gelus oculatus Say.
Acoptus suturalis Leconte.
Conotrachelus affinis Boheman.
Conotrachelus anaglypticus Say. Not uncommon.
Cryptorhynchus fuscatus Leconte.
Acamptus rigidus Leconte. (Pechuman, 1937).
Cossonus impressifrons Boheman.
Pentarthrinus parvicollis Casey. (Pechuman, 1937).
Stenoscelis brevis Boheman. Not uncommon.

SCOLYTIDAE

Scolytus multistriatus Marsham. Smaller European elm bark beetle.
Scolytus sulcatus Leconte.
Hylurgopinus rufipes Eichhoff. Native elm bark beetle.
Monarthrum mali Fitch. (Pechuman, 1937). Apple wood stainer.
Xyloterinus politus Say.
Hypothenemus punctifrons Hopkins.
Xylosandrus germanus Blandf. (U.S.D.A. laboratory at Morristown, N. J.)

DIPTERA

CECIDOMYIIDAE

Oligarces ulmi Felt. (Felt, 1917. Reared from under decaying bark).
Dasyneura ulmea Felt. Elm bud gall.
Phytophaga ulmi Beutenmuller. (Felt, 1917. Deforms young leaves).

MYCETOPHILIDAE

Leia bivittata Say. (Pechuman, 1937).

SCIARIDAE

Sciara coprophila Lintner. (Pechuman, 1937).
Sciara pauciseta Felt. (Pechuman, 1937).
Sciara sp. (Pechuman, 1937).

COENOMYIIDAE

Xylophagus lugens Loew. (Pechuman, 1937).

STRATIOMYIIDAE

Neopachygaster maculicornis Hine. (Pechuman, 1937).

DOLICHOPODIDAE

Medeterus ciliata Van Duzee. (Pechuman, 1937).

LONCHAEIDAE

Lonchaea polita Say. Pupates in bark in association with the galleries of *Hylurgopinus rufipes*.

OTITIDAE

Pseudotephritis vau Say. Pupates in bark in association with the galleries of *Hylurgopinus rufipes*.

CHLOROPIDAE

Gaurax apicalis Malloch. (Pechuman, 1937).
Gaurax montanus Coquillett. (Pechuman, 1937).

AGROMYZIDAE

Odinia maculata Meigen. (Pechuman, 1937. Reared from logs).
Agromyza ulmi Frost. (Frost, 1928).

HYMENOPTERA

XIPHYDRIIDAE

Xiphydria hicoriae Rohwer. (Pechuman, 1937).
Xiphydria sp. (Pechuman, 1937).

SIRICIDAE

Tremex columba Linnaeus. Pigeon horntail.

CIMBICIDAE

Cimbex americana Leach. Elm sawfly.

ARGIDAE

Arge scapularis Klug. (MacGillivray, 1916).

TENTHREDINIDAE

Strongylogastroidea unicincta Norton. (Pechuman, 1937).
Kaliofenusa ulmi Sundevall. Elm leaf miner.

BRACONIDAE

Capitonius erythrogaster Rohwer. (Pechuman, 1937).
Capitonius saperdae Ashmead. Parasite of *Saperda tridentata* larvae.
Atanycolus ulmicola Viereck. Parasite of *Saperda tridentata* larvae.
Spathius canadensis Ashmead. Parasite on larvae of *Hylurgopinus rufipes* and *Magdalis* spp.
Heterospilus sp. Parasite of *Saperda tridentata* larvae.
Apanteles spp. (Pechuman, 1937).
Eubadizon magdali Cresson. Parasite on larvae of *Magdalis* spp.
Eubadizon sp. (Pechuman, 1937).
Helconidea albitarsis Cresson. (Pechuman, 1937).
Helconidea ligator Say.
Triaspis curculionis Fitch. (Pechuman, 1937).
Chelonus sp. (Pechuman, 1937).

ICHNEUMONIDAE

Chaeretymma zingara DeGant, MS. (Pechuman, 1937).
Chaeretymma spp. (Pechuman, 1937).
Asphragis sp. (Pechuman, 1937).
Theronia fulvescens Cresson. (Pechuman, 1937).
Rhysella nitida Cresson. Parasite of *Xiphydria* sp.
Megarhyssa atrata Fabricius. Parasite of *Tremex columba* larvae.
Megarhyssa lunator Fabricius. Parasite of *Tremex columba* larvae.
Arotes decorus Say.
Xorides albopictus Cresson. Parasite of *Saperda tridentata* larvae.
Xorides calidus Provancher. (Pechuman, 1937).
Deuteroxorides caryae Harris. (Pechuman, 1937).
Odontomerus vicinus Cresson. (Pechuman, 1937).
Ichneumon irritator Fabricius.
Ichneumon sp.
Trichomma reticulatum Davis. (Pechuman, 1937).

CYNIPIDAE

Ibalia maculipennis Haldeman. (Pechuman, 1937).

CHALCIDIDAE

Trigonura hicoriae Rohwer. Parasite of *Magdalis* spp.
Trigonoderus algonquinia Girault.

EURYTOMIDAE

Prodecatoma sp. (Pechuman, 1937).
Eurytoma abnorme Ashmead. (Pechuman, 1937).

EUPELMIDAE

Eupelmus cyanipes var. *amicus* Girault. (Pechuman, 1937).
Eupelmus juglandis Ashmead. (Pechuman, 1937).

PTEROMALIDAE

Dibrachys sp. Parasitic apparently on *Magdalis* spp.
Rhaphitelus maculatus Walker. Parasitic apparently on *Magdalis* spp.
Cheiropachus colon Linnaeus. (Pechuman, 1937).

EULOPHIDAE

Entedon leucogramma Ratzeburg. (Pechuman, 1937).

CHRYSIDIDAE

Omalus corruscans Norton. (Pechuman, 1937).

FORMICIDAE

Camponotus herculeanus subsp. *pennsylvanicus* DeGeer. Black carpenter ant.

SPHECIDAE

Trypoxylon frigidum Smith.
Stigmus conestogorum Rohwer.
Solenius producticollis Packard. (Pechuman, 1937).

ANDRENIDAE

Halictus macoupinensis Robertson. (Pechuman, 1937).

ACARINA

PARASITIDAE

Eugamasus sp.

LAELAPTIDAE

Seius sp.

UROPODIDAE

Uropoda sp. Immature stages attached to bodies of *Hylurgopinus rufipes*.

TYROGLYPHIDAE

Histiogaster carpio Vitzthum. (*fungivorax* Jacot is no doubt this species.) In galleries of *Hylurgopinus rufipes*.
Megninietta ulmi Jacot. (Jacot, 1936).
Monieziella arborea Jacot. (Jacot, 1936).
Tyroglyphus sp.

PEDICULOIDIDAE

Pediculoides dryas Vitzthum. In galleries of *Hylurgopinus rufipes*.

TETRANYCHIDAE

Paratetranychus pilosus Canestrini and Fanzango. European red mite.
Tetranychus telarius Linnaeus. Common red spider.

ERIOPHYIDAE

Eriophyes ulmi Garman. Gall mite.

NOTASPIDIDAE

Scheloribates sp.

LITERATURE

Britton, W. E. and Friend, R. B. Insect pests of elms in Connecticut. Conn. Agr. Exp. Sta. Bul. **369**: 265–307. 1935.

Felt, E. P. Key to American insect galls. N. Y. State Mus. Bul., **200**: 120-122. 1917.

Forbes, W. T. M. The Lepidoptera of New York and neighboring States. Cornell Univ. Agr. Exp. Sta., Memoir **68**, 729 pp. 1923.

Frost, S. W. [Family Agromyzidae] in the List of N. Y. Insects. Cornell Univ. Agr. Exp. Sta., Memoir **101**: 867. 1928.

Herrick, G. W. [Insects on elm] in Insect enemies of shade trees. pp. 66–103. Ithaca, N. Y. 1935.

Hopkins, A. D. Catalog of West Virginia Scolytidae and their enemies. W. Va. Agr. Exp. Sta. Bul. **31**: 155. 1893.

Jacot, A. P. Three possible mite vectors of the Dutch elm disease. Ann. Ent. Soc. America, **29**: 627–635. 1936.

MacGillivray, A. D. [Tenthredinoidea] in Hymenoptera of Connecticut. Conn. Geol. and Nat. Hist. Surv. Bul. **22**: 163. 1916.

Parks, T. H. Insects on elms. Ohio State Univ. Agr. Ext. Service Bul. **172**, 32 pages. 1936.

Pechuman, L. L. An annotated list of insects found in the bark and wood of *Ulmus americana* L. in New York State. Bul. Brooklyn Ent. Soc., **32**: 8–21. 1937.

CONTROL OF THE SQUASH BUG

R. L. Beard

The common squash bug, *Anasa tristis* DeG., is a familiar pest of summer and Hubbard squash, and at times extensive damage to these plants is caused by the feeding of these insects when present in large numbers. Doubtless much of the injury attributed to the squash bug is actually caused by the striped cucumber beetle (*Diabrotica vittata* Fabr.), the squash vine borer (*Melittia satyriniformis* Hbn.), and the wilt disease caused by the bacterium *Bacillus tracheiphilus*. It is probably seldom that the squash bug alone completely destroys a planting of squash, but it may frequently be the contributing factor most directly responsible.

This insect is notoriously resistant to most common insecticides and for this reason control measures in the past have been principally mechanical, such as hand picking, the use of trap boards, the planting of trap crops, and the practice of clean farming.

By means of laboratory and field experiments, efforts have been directed toward finding an effective insecticide against the bug. Elliott (1935) made a series of laboratory tests, using several dusts and sprays, the most promising of which was a kerosene extract of pyrethrum. Subsequent work by the writer has subjected this material to field tests along with other insecticides which showed promise in the laboratory.

The laboratory tests included representatives of all the common contact poisons. Of the nicotine compounds, nicotine sulfate, nicotine naphthanate, nicotine cresylate, and nicotine tannate were tried with unsatisfactory results. An isomer of nicotine, anabasine sulfate, gave fair results in the laboratory, but proved to be of little value in the field. Several rotenone sprays and dusts were given laboratory trials, but none of these demonstrated sufficient toxicity against the bug to warrant field experiments. Calcium cyanide dust, although reported to be effective (Little, 1927), was given several trials and found to cause severe burning of the foliage without killing many bugs. A few proprietary contact insecticides were used with little success. The ordinary pyrethrum compounds likewise proved to be of little worth, but certain concentrated preparations are of definite value, and good control of the squash bug can be obtained by their use. The best of these is the kerosene extract of pyrethrum which Elliott recommended after laboratory tests. This preparation (Pyrocide 20) contained 2.15 percent pyrethrins; that now obtainable contains 2.4 percent pyrethrins. Essentially the same material, containing 2.0 percent pyrethrins, is available in a dust form (Dry Pyrocide), which is also effective, as will be shown subsequently. There is still a third pyrethrum concentrate which will be considered later.

In his work, Elliott used soap as the emulsifying agent for the kerosene extract. When used for field work this proved unsatisfactory because of the difficulty of getting a good emulsion with the soap when larger quantities of the spray were made up. Experiments made in the summer of 1936, using a number of different emulsifying agents in combination with the extract of pyrethrum, indicated that a self-emulsifying liquid containing sodium oleyl sulfate with a resinous sticker (SS-3) was satisfactory, and field trials were made with this combination.

These experiments utilized plots of summer squash in different locations on the Experiment Station farm at Mount Carmel. The segregation was designed to eliminate the migration of insects from one plot to the other, but cultural conditions proved to be so different that direct comparisons could not be made. And, although the plots treated with pyrethrum spray and dust gave much higher yields of squash than other plots, the increased yield could not be attributed entirely to the effectiveness of the insecticides, for the cultural conditions of these plots were better as well. Field observations indicated, however, that both insecticides consistently killed squash bug nymphs of the first four instars, and of the fifth instars if sufficient insecticide contacted them. Few adults were killed.

During the summer of 1937 efforts were made to evaluate these insecticides more exactly. A total of 114 hills of summer squash was used at the Mount Carmel farm. Ninety-six hills were disposed in a rectangular area and divided into quadrants of 24 hills each. The remaining 18 hills were adjacent to one of the quadrants. Thus, with such proximity of the plots, cultural conditions should have been uniform. To minimize migration of bugs from one plot to another, a barrier was interposed between adjacent plots. This consisted of a muslin fence, the lower margin of which was buried in the ground, and the upper part smeared with tanglefoot. However, this barrier did not preclude the possibility of adult bugs flying from one plot to another, or of nymphs walking around the ends. There was little evidence that either of these activities occurred to any appreciable extent.

The quadrant containing the most vigorous squash plants was chosen as a check plot, so that any differences which showed up would represent minimum variations and hence be more significant. In another quadrant the plants were gone over carefully by hand, and the eggs of the bug were removed at 10-day intervals, beginning July 9. The third quadrant was treated with the concentrated pyrethrum dust mentioned before. This material is a kerosene extract of pyrethrum carried by diatomaceous earth and contains 2.0 percent pyrethrins. One part of this concentrate was diluted with nine parts of talc in these treatments. The final quadrant was treated with the kerosene extract of pyrethrum in spray form. The concentrate contains 2.4 percent pyrethrins and was diluted 1 to 500. This was emulsified with a sodium salt of water-soluble sulfonic acids (Ultrawet), which forms a somewhat better emulsion than the rosin-residue spreader used in 1936 and is easier to handle. One part of this spreader is used to 1000 parts of finished spray. The mixture is the insecticide designated as *Spray A* in the figures below. The plot composed of 18 hills was treated with a proprietary spray (DX), which is an extract of pyrethrum, together with an emulsifying agent. This material was used at a dilution of 1 to 200. It is designated as *Spray B* in the figures below.

The insecticides were applied on July 20, July 30, and August 13. Before and after each of the first two applications squash bug counts were made on five hills in each of the quadrants, and on four hills in the smaller plot, and averages were obtained. The data are graphically shown in Figure 22. A similar count was made on August 27. By this time practically all of the season's eggs had been laid, and more than 95 percent of these had hatched. This count is shown graphically in Figure 23.

It will be observed in Figure 22, for the check plot, that the number of bugs in the count made after the treatment is greater than the number before treatment. Such a result is to be expected, for at the later date the hatching of eggs is at its peak. This would suggest that the effect of the insecticides was even greater than indicated, a fact borne out by the observation at the time of the second count in the treated plots that many of the insects were in the first instar, presumably having hatched after the application of spray or dust. In all three of the treated plots, however, a significant decrease in the insect population was noted.

Figure 23 represents what might be considered the final population count. It is obvious that all treatments markedly reduced the number of insects. However, even the hand picking of eggs did not result in elimination, probably due to failure to remove all the eggs, although there might have been a slight amount of migration.

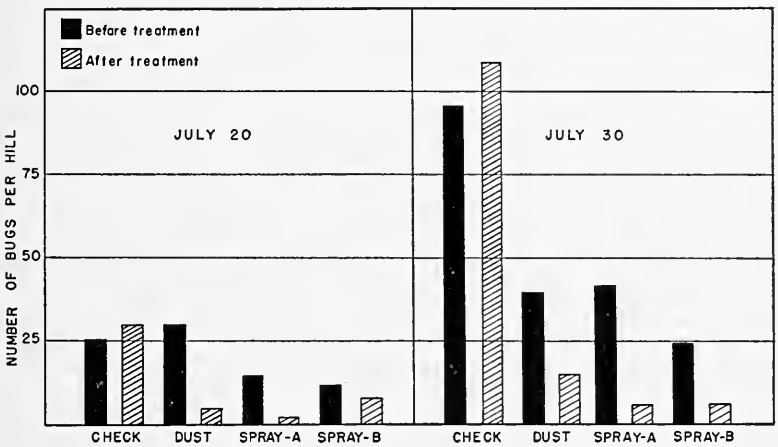

FIGURE 22. Chart showing squash bug population, before and after treatment.

From inspection of this figure alone, it would seem that Spray B was the most effective. This is rather surprising considering the lower effectiveness in killing the bugs as indicated in the summary below. However, this lower final population is less real than apparent, for it will be noted that in all three counts the insect population is less in this than in the other plots. Unfortunately, it would not be justifiable to equate these counts on the basis of the population at the time of the first count, for it can be seen that although the number of insects present after the first treatment is less in the plot treated with Spray A than in any other plot, the number at the time of the next count is greater in this plot than in any other treated plot. This suggests a lag in the reproduction of the bug early in the season and indicates a larger number of egg-laying adults. There is a similar, but less pronounced tendency in the dust-treated plot. Consequently the effectiveness of the insecticides can better be considered on the basis of individual applications.

The tabulations below, obtained from data in these counts as well as data from laboratory tests, indicate this effectiveness in killing the bugs.

	Percentage of bugs killed by:			
	Dust	Spray A	Spray B	Check
Field tests				
July 20—all stages of bug	78.7%	81.9%	55.0%	0.0%
July 30—all stages of bug	60.2%	83.9%	74.7%	0.0%
Average	**69.5%**	**82.9%**	**64.9%**	**0.0%**
Cage tests				
Adult bugs	54.8%	52.3%	0.8%	1.8%
Fifth instar nymphs	52.9%	48.3%	10.0%	6.3%

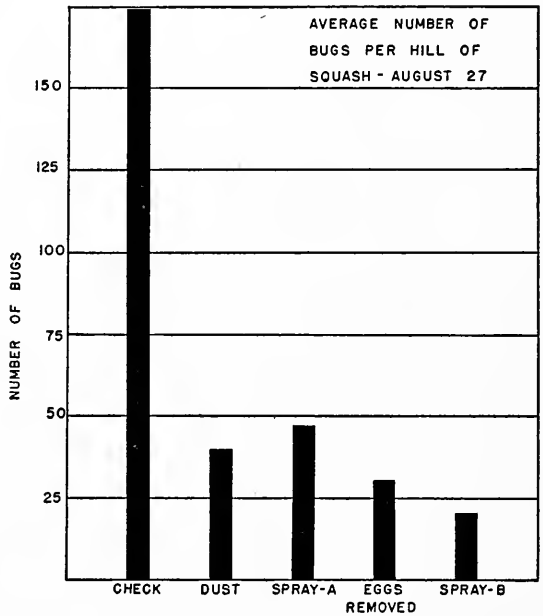

FIGURE 23. Chart showing average number of squash bugs per hill, on August 27, after treatment.

In these cases, Spray A is more consistently effective than the others. In the cage tests, it is somewhat less effective than the dust, but not significantly so. The greater effectiveness of these materials against adults than against fifth instar nymphs is not sufficient to be significant. These cage tests show that Spray B is of no value against older nymphs and adult bugs. The higher percentage kill in the field applications over the cage tests is due to the fact that in the former, the majority of the insects were nymphs of the first three instars, which are much more susceptible to toxic substances. The wide differences in results of the two field applications of the dust and Spray B cannot be explained. The temperature, humidity, and weather conditions on the two dates were practically the same.

A further consideration of the effectiveness of the insecticides may be made in reference to the crop yield. The following table shows the yield, in pounds of squash for each plot, tabulated for two-week intervals.

	Number of pounds of squash produced				
	Check	Dust	Spray A	Spray B	Eggs removed
July 3–17	103	87	61	72*	68
July 18–31	66	53	77	64	57
August 1–14	93	68	105	87	60
August 15–28	14	34	62	49	25
August 29–Sept. 11	0	18	45	62	23
Total	**276**	**260**	**350**	**324**	**233**

(* Inasmuch as the plot treated with Spray B contained only 18 hills as against 24 in the other plots, the figures given here are weighted so as to be comparable; i.e., the original figures were divided by .75.)

Here, obviously, the plot treated with Spray A is the best, having produced about 27 percent more than the untreated plot. The total yield, however, does not reflect the damage done by the squash bug alone. The wide variations observed among the treated plots indicate other factors. If the bug alone were responsible, the plot treated with Spray B (see Figure 22) and the plot from which the eggs were removed should have the highest yields, unless the treatments themselves had deterrent effects. This latter does not seem likely, for no correlation was observed between the time of treatment and any decrease in yield. Probably the most important single factor, other than the bug, to account for such diversity among the total yields, is the presence of the squash vine borer. All of the squash in the planting were infested with this borer, but it is unlikely that all hills were infested to the same extent.

The significant thing about these data on yield is that the control of the bug extends the period of squash production by fully a month. By the middle of August, the vines in the check plot had begun to die down completely to the ground. This is reflected in the sudden drop of squash yield. By the end of August, the entire plot was destroyed, whereas all of the treated plots continued to produce squash. Although no records were made after September 11, squash were produced until the time of frost.

Considering all aspects of the above data, it may be concluded that Spray A is to be recommended over the other insecticides, unless ease of application is desired at the expense of effectiveness, when the dust may be used. Spray B can be effective if particular care is exercised to time the treatment to get the youngest squash bug nymphs.

In any case, the time of treatment is important. Hoerner (1937), in Colorado, also found this pyrethrum dust to be effective, but he recommends using it against the adults early in the season before oviposition begins. This, however, demands a much more concentrated dust (1 part of concentrated dust and 5 parts of gypsum), and from 12 to 18 applications, for the adults appear in the field over a period of weeks, and each application suffices for only about two days. If, on the other hand, efforts are directed against the young nymphs, three applications are sufficient.

The first eggs hatch about the first week in July. By the beginning of the third week in July a few nymphs will reach the fourth instar. The first spray application should be made at this time, when the majority of the

insects will be in the first three instars. The second application should be made ten days later, for during that interval the hatching of eggs will be at the season's peak. The third application should be made ten days or two weeks later. If Spray B is used, four applications should be made, the first by the middle of July, and the others following at no greater than 10-day intervals.

In preparing Spray A, the emulsifying agent is vigorously mixed with a small amount of water. Then, while still stirring, the kerosene extract of pyrethrum is slowly added. This mixture is then brought to the proper dilution. (1 part emulsifying agent, 2 parts pyrethrum, 1000 parts water.) The proprietary pyrethrum concentrate needs only to be added to water—1 part of the concentrate to 200 parts of water. Both of these sprays are quick-breaking emulsions which must be agitated during the application. The dust needs no special preparation, but talc is to be recommended as a diluent over sulfur or gypsum. (1 part concentrate to 9 parts talc.)

In the application of any of these, it is essential that the insect be actually covered by the insecticide, for it is only by contact that the poison acts.

LITERATURE

Elliott, D. C. Conn. Expt. Sta., Bul. **368**: 224–231. 1935.
Hoerner, H. L. Jour. Econ. Ent. **30**: 375. 1937.
Little, V. A. Jour. Econ. Ent. **20**: 575. 1927.

THE PERIODICAL CICADA IN CONNECTICUT IN 1937

Magicicada septendecim Linn.

J. A. Manter

The writer was informed over the telephone on June 7, 1937, by Mr. Wesley Hansen of the appearance of the periodical cicada in the town of Willington. That same evening he visited the locality and found, as reported, a thriving colony of cicadas in a pasture near the home of Mr. John Blahusiak in the eastern part of the town.

Two broods of the periodical cicada have been known in Connecticut. Brood II has appeared regularly every 17 years in the central part of the State and was last seen in 1928. Brood XI has occurred in much smaller numbers quite irregularly, and was last reported by entomologists in 1886. This brood has been found only in the states of Massachusetts, Rhode Island, and Connecticut, and in only a few localities in each. The records of its recent appearances have been quite meagre, substantiating the belief that it is on the verge of extinction. The only Connecticut record of its occurrence in 1903 which has come to notice was a letter to the Hartford *Courant* printed in the issue of June 6 as follows:

To the Editor of The Courant:-

Seventeen years ago this month on a hill near this town in the forest appeared vast numbers of locusts. They covered a space of two or three acres of ground. The trees and bushes were completely covered with them and the shells which they come out of. They now have appeared in the same place. The noise that they make can be heard a mile away. The forest seems alive with this wonderful insect.

Willington, June 5 X. Z.

A few local residents remember hearing the cicadas in 1920 from the same locality but apparently the colony attracted very little attention at that time.

Colonies of this brood were reported from Rhode Island in 1903 in two localities, but no published record of its appearance in 1920 has been noticed. Several entomologists searched for it in places where it had occurred previously without finding a single specimen. Therefore it seemed unlikely that any cicadas of brood XI would be found in 1937, which made the Willington colony quite unexpected. No other records of this brood for 1937 have come to the writer's notice, which leads to the speculation that this may be the last remnant of brood XI.

The Willington colony covered an area of about 10 acres. The greatest numbers appeared just east of the road with very few on the west side where the land was lower and somewhat wet. The pasture was partially wooded with white pine and various hardwoods, but with open areas where trees had been cut in recent years. On the east was an open low field, and just beyond, a hillside of mixed hardwoods where a smaller number of cicadas appeared.

The owner first heard the cicadas on the fifth of June. Two days later there were many thousands clinging to the trees and shrubs and their empty nymphal cases were very numerous especially about the bases of the trees. Within a week egg laying could be observed, and by the end of the second week the injured branches were conspicuous at a distance by their wilted and brownish condition. Several species of birds were seen in rather more than normal numbers about the pasture trees and some were observed feeding on the cicadas. On the twenty-second of the month cicadas were still emerging from the ground and 90 newly emerged individuals were collected in an hour just before dark. Two days later live cicadas were very difficult to find and none was seen after this date. Their disappearance was almost as sudden and unexpected as was their first appearance.

After spending 17 years in the ground, feeding and growing, these insects had less than three weeks of adulthood in the world above. Their dead bodies and cast off skins became less noticeable through the summer, but the effects of their egg laying became more pronounced as leaves turned brown and small branches broke. Egg punctures were found in the following species of plants:

wild indigo *Baptisia tinctoria* Linn.
gray birch *Betula populifolia* Marsh
black oak *Quercus velutina* Linn.
white oak *Quercus alba* Linn.
poplar *Populus tremuloides* Michx.
dwarf sumach *Rhus copallina* Linn.
blueberry *Vaccinum atrococcum* Heller
staghorn sumach *Rhus typhina* Linn.
pignut hickory *Carya glabra* Britt.
alder *Alnus incana* Linn.
bayberry *Myrica carolinenses* Mill.
white ash *Fraxinus americana* Linn.
witch hazel *Hamamelis virginiana* Linn.

None was found in the pines although cicadas frequented these trees. The eggs hatched during August and the young cicadas entered the ground to begin their 17-year subterranean existence. If all goes well with them they may be expected to reappear in 1954.

PRESENT STATUS OF MOSQUITO CONTROL WORK IN CONNECTICUT, 1937

R. C. Botsford

Throughout the season the regular maintenance crew of nine men patrolled the salt marsh areas which were accepted for state maintenance in the towns of Stamford, Norwalk, Westport, Fairfield, West Haven, New Haven, Hamden, East Haven, Branford, Guilford, Madison, Clinton, Westbrook, Old Lyme, Groton and Stonington. Although the total acreage of salt marsh in the State of Connecticut has been ditched, only areas in these towns have been accepted for maintenance. Verbal inquiries concerning state maintenance in other ditched towns have come to our attention but more particularly from the Silver Beach Improvement Association in Milford. This was in the form of a petition for maintenance in the salt marshes of that community and was signed by more than 80 persons. A slight increase in maintenance funds has allowed maintenance work by three men to continue throughout the winter. It is quite apparent that the ditches in certain salt marsh areas require overhauling each year, while in other areas the ditches maintain themselves almost indefinitely.

In the towns of West Haven, New Haven and East Haven, construction work during the mosquito breeding season flooded some of the salt marsh area and sufficient mosquitos emerged to become a definite nuisance in these towns. In West Haven the difficulty was caused by a break and subsequent repairs on an outfall line from the sewage disposal plant together with an insufficient outlet of the Oldfield Creek at Beach Street, causing flooding of the salt marsh area from Peck Avenue to Beach Street. This area was sprayed with light fuel oil by the use of a portable sprayer recently purchased. The oil and labor were supplied by the town. It is expected that this violation will be corrected, making recurrence of the trouble impossible in the future.

In Nathan Hale Park, dikes to confine the settling basins in connection with the harbor dredging resulted in insufficient drainage and the formation of large mosquito breeding areas, necessitating oiling at regular intervals.

In East Haven, scattered breeding areas were formed due to construction work on the tide gate below South End Road. These were so inaccessible that no attempt was made to control the mosquito breeding.

A mosquito nuisance in the town of Old Lyme brought forth the following resolution in a regular town meeting March 1, 1937.

"WHEREAS, It is rumored that the State of Connecticut intends to obstruct the mosquito ditches and to flow water holes on the Great Island, so-called in the town of Old Lyme, and WHEREAS the town of Old Lyme has expended large sums of money to eliminate the mosquito nuisance, and WHEREAS in the opinion of the electors of said town of Old Lyme, the said obstruction of the mosquito ditches and flowing of the water holes would be detrimental to the best interests of said town of Old Lyme and would again provide breeding places for mosquitoes,

"RESOLVED, That the Selectmen are hereby authorized to protest to the State of Connecticut against any such obstruction of the mosquito ditches and flowing of the water holes and in connection therewith, to take any and all action which they may deem to the best interests of said Town of Old Lyme."

Signed: E. Lea Marsh, Jr.
Robert H. Noble.

The WPA Ditching, Draining and Pest Control Project sponsored by the Station was continued with an average of 600 men and is briefly described in the following resumé:

Ansonia: Work in this town was reopened in order to clean Beaver Brook. Parts of this stream had been used for a common dump, and in other spots swampy mosquito breeding areas existed. The stream has been cleaned and, where necessary, the banks are being walled up.

Branford: A leak under the Branford River tide gate sill was satisfactorily sealed and the gates are in service.

The construction of the new tide gate at Stony Creek was continued with a small force of men. The concrete work comprising the sill and the two abutments is completed. The main ditch is under construction.

Derby: The outlet to Derby Meadows near the carbarns has been completed, the 48-inch pipe being extended northward to the arch bridge and southerly about 200 feet to do away with a deep excavation.

East Hartford: The new culvert installed at Pitkin Street is completed, including the construction of head walls and permanent grading.

Work has been concentrated on drainage of swampy areas in the Willow Brook area. At one point a ditch has been extended to a branch of the Pewter Pot Brook which will relieve flooded conditions in the Willow Brook area near Silver Lane. Property owners here made generous contributions of tile pipe.

East Haven: A short section of Tuttle Brook near Burr Street was walled up to prevent undermining of the sandy banks.

East Lyme: At the outlet of Bride Brook in Rocky Neck Park two lines of 36-inch pipe were installed to effect the drainage of the salt marsh. This work has been suspended for a short time.

At Crescent Beach a pipe line with tide gate well is being installed to control the water level in the swamp.

Fairfield: The new tide gate well at Fairfield Beach and the pipe line extending inland to the swamp are nearly completed.

At Gould Manor ditches were extended to swampy areas and water discharged into an old outlet, which was regraded and otherwise improved.

Groton: An unsightly and insanitary area called Lake George was drained and a head wall with slots to accommodate any height of weir boards was constructed for the purpose of flooding the area for future park development.

The Wild Cat Swamp area was surveyed by the borough engineers and the ditching work started. Materials for this work were contributed locally.

Guilford: Work at Indian Cove has been suspended temporarily.

At Great Harbor, material for the construction of a jetty has been delivered.

Madison: Bailey Brook has been regraded and swampy areas eliminated.

A new 24-inch concrete pipe line is being installed at the outlet of the Country Club marsh. A tide gate well was also constructed to prevent tide water entering the area, if necessary.

Manchester: The outlet at Boggy Stowe and pipe line are completed, and the main ditch through the swampy area is nearly finished.

Milford: The work at Point Beach has continued, and a long section of open ditch in the rear yard of cottages has been replaced by a pipe line, back filled, and graded.

New Haven: An entirely new tide gate structure on Morris Creek, south of South End Road, to replace one repaired under the CWA, is nearly completed. The tide gates are in operation and the remaining work can be completed in a relatively short time.

North Haven: Work here consists of draining fresh water swamps bordering the salt marsh area.

Norwalk: The main ditch extending from the new tide gate well to the state road is stoned up and completed. A new concrete culvert, complete with head walls, has been placed under the roadways, and the work has been extended into the salt marsh area.

Old Saybrook: At Chalker Beach a new pipe outlet was installed, including a tide gate well complete with tide gate.

At Saybrook Manor a tile pipe was laid at a lower level to permit the proper drainage of a salt marsh area. Provision was also made for a storm sewer connection.

Southington: The work on the Quinnipiac River is completed as far as permission could be secured for this improvement.

A swampy area at Eden Avenue is being filled with material from nearby hills.

Stratford: Repair work on the Great Meadow dike was reopened. The tide gates have been put in place and are in operation. A break in the dike has been closed and the foundation for the new dike has been laid.

The Filter Bed job, which has been discontinued from time to time, is completed with the exception of the head wall and the adjacent pipe line.

West Haven: Most of the work in West Haven has been in the Cove River area. At Saw Mill Road a walled-up section of ditch was installed.

Construction work has been started on the outlet of Oldfield Creek at Beach Street, together with a ditch extending from that point to the Blohm Street culvert. The town of West Haven is supplying the materials for this work.

Westport: The tide gate well at Minute Man Statute has been completed. It was intended to regrade the ditch in the swampy area. However, the owner of the property contributed sufficient tile to do away with the entire length of the open ditch. This tile has been laid, back filled and graded. Other property owners have contributed pipe to continue the work.

Applications for additional projects have been received from the towns of Bethel, Bristol, Danbury, Derby, East Hartford, Glastonbury, Madison, Meriden, New Britain, Norwalk, Old Lyme, Old Saybrook and Stamford. All the areas under consideration in these towns have been viewed by representatives of the United States Bureau of Biological Survey or representatives of the State Board of Fisheries and Game. When any new project is formally approved by these two agencies, application is made for Federal funds. A certain percentage of the cost of the work is carried by the town in the form of contributed materials and tools.

All of the areas corrected lie within or near urban settlements and have been proven mosquito breeding places or a definite sanitary menace.

MISCELLANEOUS INSECT NOTES

Prevalence of Potato Leafhopper. The potato leafhopper, *Empoasca fabae* Harr., was exceedingly prevalent in 1937. Mr. Turner reported it as abundant on potatoes and stated that unsprayed fields showed severe tip burn the middle of July. This leafhopper also infests apple foliage, and according to Doctor Garman, it was more prevalent in Connecticut apple orchards than for the past 10 years. However, as most of the leafhoppers were on the terminal leaves, they caused no commercial damage to the apple crop. [W. E. Britton]

Raspberry Plants Damaged by *Phyllophaga tristis*. Raspberry plants in Orange were damaged by a small June beetle and 68 specimens were received at the Station, June 1. The beetles were identified as *Phyllophaga*

tristis Fabr., one of the smaller species of May or June beetles. It is light brown and somewhat more hairy than most of the larger species. This insect damaged plants in the same raspberry plantation in 1933, and specimens were sent to the Station. The same year similar damage was reported from Easton. [W. E. Britton]

Canker Worms in 1937. Both the fall canker worm, *Alsophila pometaria* Harr., and the spring canker worm, *Paleacrita vernata* Peck, were less troublesome than in 1936. This office has no specific records of damage by the spring canker worm, but probably such damage occurred in certain localities. The fall canker worm was rather abundant locally on apple and elm in Litchfield County, and according to Dr. E. P. Felt was somewhat numerous in the vicinity of Stamford. Caterpillars were received from Groton, June 4, and riddled elm leaves from Mystic, July 3.

[W. E. Britton]

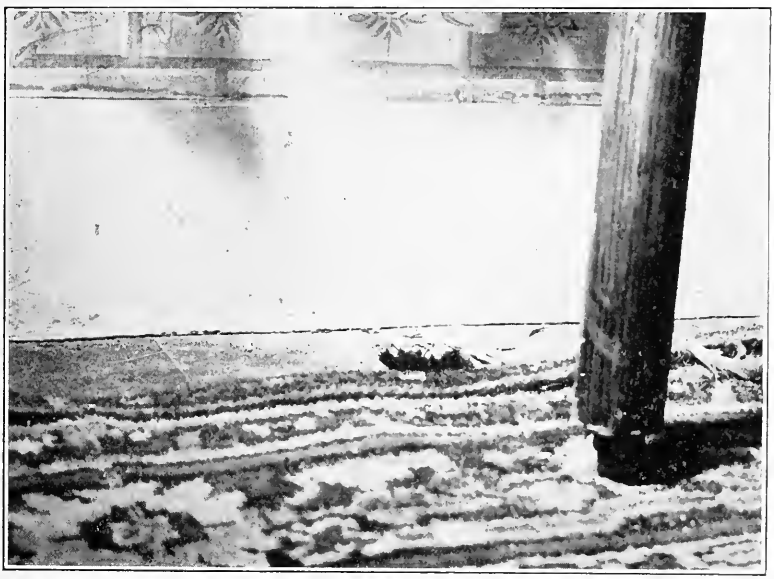

Figure 24. Floor damaged by the furniture beetle, and hole where one leg of the bed broke through it.

Damage to a House by the Furniture Beetle. In October, 1937, a call was received from Middletown stating that a floor had collapsed as a result of termite attacks. Investigation showed that one leg of a bed had dropped through the floor and that the entire floor was severely damaged by the furniture beetle, *Anobium punctatum* DeG., as shown in Figure 24. This floor was made of pine lumber and there was no subfloor. The house was about 25 years old, and there was no heat or ventilation in the basement. The floor was so badly damaged that it was necessary to replace it.

[Neely Turner and B. H. Walden]

Records of Ticks in Station Collection. *Dermacentor variabilis* Say, dog tick, from dog, Nantucket, Mass., July, 1921; Chatham, Mass., June 30, 1929; Wethersfield, Conn., August 30, 1932; Saybrook, Conn., August 31, 1932; from woman's scalp, Stratford, Conn., July 1, 1937. (Patient returned from Eastham, Mass., a week before.) *Ixodes hexagonus* var. *cookei* Pack., from dog, Stamford, Conn., July 19, 1927; from woodchuck, North Branford, Conn., August 7, 1934. *Riphicephalus sanguineus* Latr., from dog and also in cracks of wood finish in house, New Haven, Conn., August 19, 1937. [W. E. Britton]

Plant Bugs on Peaches. Considerable damage to peaches was observed in various peach orchards again this year. At the Mount Carmel farm, injury occurred over the entire plot of three acres in such intensity that at least 15 percent of the fruit was marked even after careful thinning. The damage was much worse on trees 50 to 75 feet from an adjoining wood lot, but fruit on trees several hundred feet away was also punctured. Continued study of the problem is planned for 1938. Injury in this case was probably due to the oak plant bug, *Lygus quercalbae*, or closely related species. [Philip Garman]

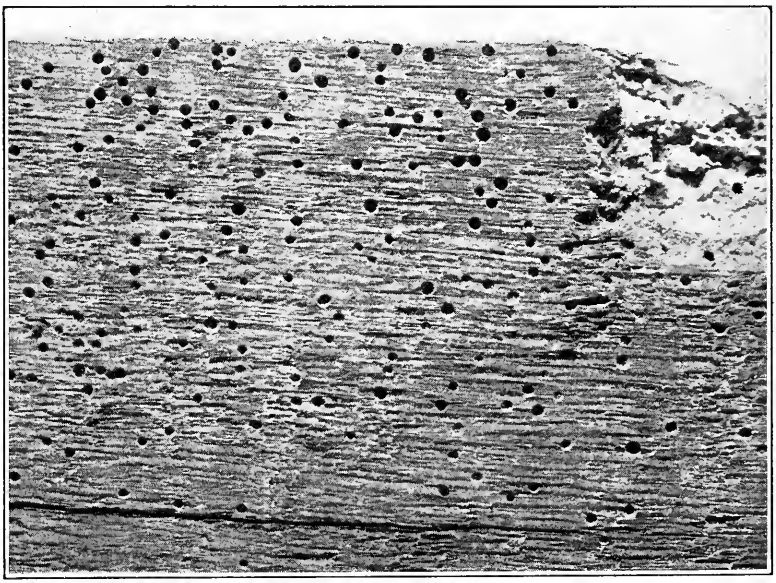

Figure 25. Coniferous floor board from the Webb House, Wethersfield, damaged by the furniture beetle. Natural size.

Lawns Damaged by *Ochrosidia villosa* Burm. In 1936 the grubs of this native Scarabaeid beetle caused severe damage to a lawn in Greenwich, and in 1937, grubs of this species were received from Greenwich. On September 13, grubs were received from East Norwalk, where a lawn had been injured by them. Mr. Johnson visited the place and reported that about three acres of the lawn on a small estate had been severely damaged. On October 22, many adults were received from Southport, in the town of

Fairfield. Thus it will be seen that in the season of 1937, in addition to several introduced lawn insects, this native pest has injured lawns locally in three different and non-adjacent towns. [W. E. Britton]

Damage by Wireworms. On May 4, Mr. Stoddard brought to the Station some lettuce plants injured by wireworms, from a market garden in Fairfield near the Bridgeport town line. Mr. Turner visited the field on the same day and reported that about half the plants in a half-acre field had been destroyed by wireworms. The wireworms were examined and proved to be a species of Melanotus. The eastern field wireworm, *Limonius* (*Pheletes*) *ectypus* Say, was reported by A. W. Morrill, Jr. as being rather destructive in certain fields in Hartford County. One oat field, formerly in tobacco, was a 50 percent loss. Many tobacco fields required the resetting of plants in small areas. One five-acre shade tent tobacco field had to be entirely reset. [W. E. Britton]

The Tent Caterpillar in 1937. In general this insect was much less prevalent than in 1935 and 1936, but nevertheless there were certain localities where trees and shrubs were stripped of their leaves and nests were extremely abundant. The writer observed wild cherry trees and bushes in this condition in Bethany, Woodbridge and Oxford. Mr. McFarland, of this department, reported heavy infestation in the towns of Bloomfield, East Granby and Windsor, where there were nests not only on wild cherry and apple, but also on birch, oak, poplar and even white pine, trees not usually infested. The tent caterpillar, *Malacosoma americana* Fabr., is now on the decrease and for the next two or three seasons may be expected to be less prevalent than in 1937. [W. E. Britton]

Hornworms on Tobacco. Mr. A. W. Morrill, Jr., of the United States Bureau of Entomology and Plant Quarantine, who is stationed at the Tobacco Substation in Windsor, has reported to the Insect Pest Survey Bulletin that hornworms were exceedingly abundant in the Connecticut River Valley tobacco fields in 1937, particularly on the suckers or sprouts after the crop had been harvested, which are of no commercial value. However, much damage was done to the crop before harvest. Some tobacco growers considered the attack on suckers to be the worst in 43 years. This damage was caused chiefly by the tobacco worm, *Protoparce* (*Phlegethontius*) *quinquemaculata* Haw., although *P. sexta* Johan., was present and causes the same type of damage, but the former was much more abundant than the latter in the tobacco fields of Connecticut. [W. E. Britton]

A New Species of Mealybug in Connecticut. On April 30, 1924, a branch of yew (Taxus) was received at the Station from Cobalt, heavily infested with some kind of mealybug. Specimens were submitted to the Bureau of Entomology at Washington and identified as *Pseudococcus kraunhiae* Kuw., by Mr. Harold Morrison,[1] who was unable to associate this material with any other described species, and pointed out that possibly it had not been described. Later, Professor G. F. Ferris, of Stanford University, showed that *kraunhiae* is something entirely different. Mr. George J. Rau has recently studied the mealybugs, including the material identified as *kraunhiae* and other mealybug specimens on Taxus, particu-

[1] Britton, W. E. Mealy Bug on Taxus, Conn. Agr. Exp. Station, Rept. 1924. (Also Bul. 265: 338.)

larly some collected by Mr. J. P. Johnson in Greenwich, June 10. From this material he has described a new species, *Pseudococcus cuspidatae* Rau,[2] shown in Figure 26. [W. E. Britton]

Peach Borer in Nursery Stock. On November 8, 1937, the writer visited a nursery field in Ellington, near Rockville, owned by C. R. Burr and Co., where the trees were heavily infested with the peach borer, *Conopia exitiosa* Say. Digging operations were in progress at the time of the inspection and many trees were being discarded. The men in charge estimated a loss of 10 to 30 percent varying from one portion of the plot to another. The entire block was said to contain a total of 125,000 trees, and a loss of 20 percent would mean in round numbers 25,000 trees. At the current price for peach trees this represents a considerable monetary loss on the part of the nurseryman. No predisposing factors in the location were evident, the plot being on uniformly level ground with sandy soil. The trees were said to be the first grown at that location for several years. [Philip Garman]

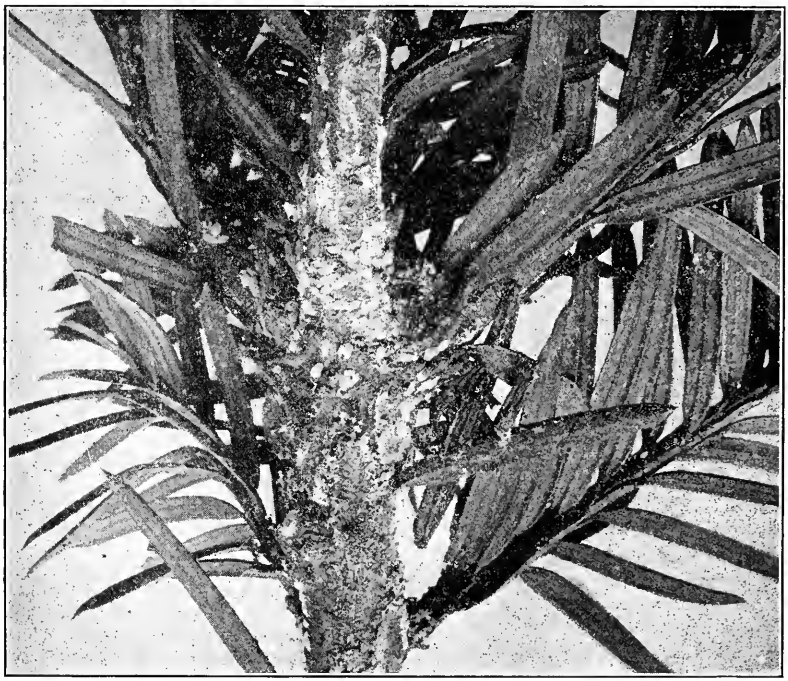

Figure 26. New species of mealybug. *Pseudococcus cuspidatae*, on Taxus.

Young Chestnut Trees Damaged by June Beetles. Damage to the foliage of young Japanese and Chinese chestnut trees in a small plantation in Bristol was reported to the Station by the Hartford County Farm Bureau, and on June 18 a specimen was received from the owner. The specimen was recognized as one of the species of Phyllophaga but it seemed different

[2] Rau, G. J. Two Apparently Undescribed Mealybugs from New York State. Bul. Brooklyn Ent. Soc., 32: 195. Dec. 1937.

from the identified species in the Station collection. The specimen submitted was a female, and the keys are based upon males. However, Mr. Zappe has examined it and considers it to be *Phyllophaga fusca* Frolich, a common species in Connecticut. A lead arsenate spray was recommended and the correspondent stated (June 21) that since applying it he had not seen any of the beetles, except many dead ones under stones. Before applying the poison he picked off several pounds of them. They swarmed upon the trees from about 9:30 to 10 P. M. on warm nights.
[W. E. Britton]

Nacerda melanura **Linn. in a Store.** In June, 1937, a large number of beetles appeared in a clothing store in New Haven. Examination showed that hundreds of adult *Nacerda melanura* Linn. were present. Most of the beetles were in the basement, but a few were found on the second floor and many on the first floor of the building, which is of modern steel and concrete construction. The beetles were not present out of doors nor in adjoining buildings. Moreover, there seemed to be no damp wood in the building in sufficient quantity to breed such a large number of beetles. It seemed possible that the larvae might have developed on rotten wood beneath the concrete basement floor. This insect has been destructive to marine docks and piling above high water. According to Balch (Can. Ent. 69: 1–5, 1937), it has infested rotten wood in many regions, in one case under the floor of a gasoline station in Ottawa. [Neely Turner]

Dahlias Damaged by Spotted Cucumber Beetle. On October 4, specimens of the spotted cucumber beetle, *Diabrotica duodecimpunctata* Fabr., were received from Bridgeport with a statement that these beetles had attacked dahlia blossoms and had perforated the petals particularly of the white and yellow varieties. A remedy was requested. Most of the literature states that this insect, which is also called the southern corn root worm, may be controlled in the same manner as the striped cucumber beetle, *Diabrotica vittata* Fabr. However, on field and garden crops both beetles damage the leaves and roots of the plants and not the flowers. It is undesirable to apply any insecticide that may discolor the flowers or leave a conspicuous residue upon them. The correspondent was advised to spray with one of the commercial preparations containing rotenone or pyrethrum, which are known not to discolor the flowers. [W. E. Britton]

Plum Petals Devoured by a Scarabaeid Beetle. On May 15, specimens of a small native Scarabaeid beetle, *Hoplia trifasciata* Say, were received from Bethel, with the statement that these beetles were devouring the petals of a plum tree which was then in full bloom. Usually this beetle is not very prevalent and is not regarded as a pest. Occasionally it is found on the flowers of hawthorn and feeding upon the leaves of various kinds of trees and shrubs in hedge rows and woodlands. Often this beetle is taken in the net when sweeping over oak and other sprout growth in cut-over woodland. It is about one-fourth of an inch in length, light brown with gray pubescence on the margins of the thorax and three bands of gray across the wing covers. The owner states that no fruit was harvested from the plum tree and he did not notice any small plums that would indicate that the flowers had been pollinated. [W. E. Britton]

Strawberry Plants Damaged by a Leaf Beetle. On May 10, several beetles were received at the Station from the County Agent of Tolland County, who stated that they were found feeding on the leaves of strawberry plants on a farm in the vicinity of Bolton and Manchester. The beetles proved to be a common species, *Paria* (*Typophorus*) *canella* Fabr., known as one of the strawberry root worms. The larvae or grubs feed on the roots, and the adults often riddle the leaves in May and early June. There is only one generation each year and the beetles emerge in late summer, live through the winter as adults, and lay eggs the following May. To control the leaf injury, the plants may be dusted or sprayed before blossoming, with lead arsenate. After blossoming, ground derris should be applied as a dust. In fact, derris may be used altogether, but in some instances the owner may have lead arsenate on hand and it is safe to use it on the plants before they blossom. [W. E. Britton]

Rose Chafer Abundant Locally. Mr. Botsford, who lives on Kneeland Road on the east side of New Haven Harbor, reported that the rose chafer, *Macrodactylus subspinosus* Fabr., was very abundant on his place in June and had partially defoliated various deciduous trees and shrubs. Adults fed upon walnut leaves and injured the trees in Bridgeport, June 7. Dr. E. P. Felt reports that various shrubs and plants in Darien were damaged by the adults. Sprayed apple trees in Guilford, June 15, were severely damaged, and peach fruit was received from Hartford, June 28, and August 16, that had been injured by the adult beetles Mr. Zappe observed it to be very abundant in shore towns east of New Haven, and it caused severe damage to garden plants in New Haven and Woodbury. Mr. Johnson observed it as numerous in Waterbury, June 17, feeding on rose leaves and the flowers of Ibota privet. Generally, this insect was not uncommonly abundant, but in certain localities caused noticeable damage.
[W. E. Britton]

A Wood-boring Wasp. On August 31, a piece of punky or partially decayed pine board from the cornice of a house porch in New Haven was brought to the Station. Because of a leaky roof, the piece of wood had been kept moist and had been drilled full of holes, some of which contained fragments of Tabanid and other flies but at first no other insects were seen. The wood was broken and split apart and all tunnels carefully examined with the result that several cocoons of a small wasp were found. Specimens soon emerged that resembled those of the genus Crabro. Specimens were sent to the Bureau of Entomology and Plant Quarantine, Washington, D. C., and were identified by specialists as *Solenius* sp., formerly regarded as a subgenus of Crabro, and, of course, split off from that genus. As all of the specimens were males, and the species are separated on female characters, the insects could not be specifically identified. In all probability these insects would not burrow in perfectly sound wood to make their nests, but they certainly used every portion of this punky wood for the purpose, as shown in Figure 27. [W. E. Britton]

Typhaea fumata **Linn., a Nuisance in a Dairy.** In the fall of 1936 this insect was sent to the Station with a letter stating that it was breeding in ground limestone. Upon investigation it was found to be present throughout a dairy barn and adults were dropping into the limestone after the bags had been opened. None were found in closed bags nor were any

immature stages found in any of the limestone. At this time the loft of the barn was full of hay and it was suspected that adults dropped out of the hay and crawled around. Beetles were found all over the barn, especially around windows and on the side walls. Upon request of the owner, the barn was visited again on June 22, 1937. Beetles were more abundant than in the fall and were crawling into the milk house adjoining the barn, getting into milk pails, cans, bottles, etc. The milk house was painted white and beetles being brown were quite conspicuous. The barn was thoroughly examined as all hay had been used. Many beetles were found in the chaff in the haymow where they were evidently breeding in large numbers. They were also abundant in dried ensilage that had been spilled near the silos. [M. P. Zappe]

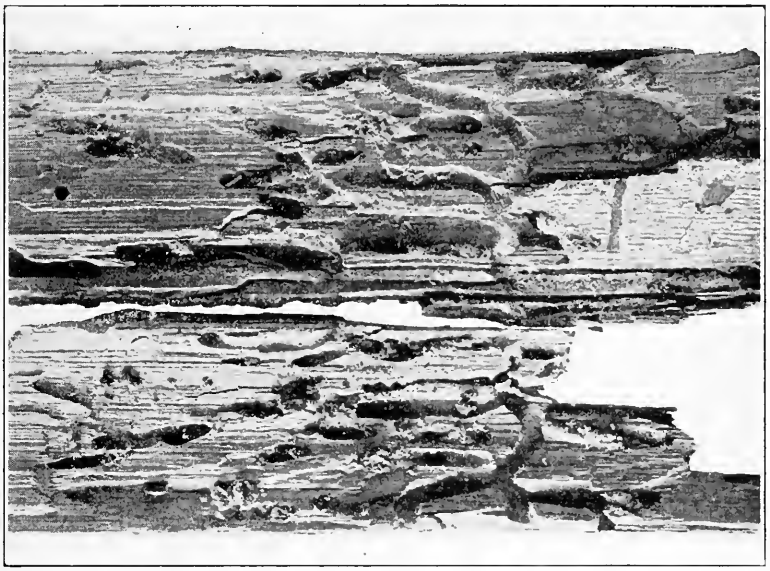

Figure 27. Punky pine board tunneled by a wood-boring wasp, *Solenius sp.*

Damage to Ears of Corn by Corn Root Worm. On September 2, a dozen adult beetles of the corn root worm, *Diabrotica longicornis* Say, were received from Lakeville, with the following statement: "They are doing quite a bit of damage to the corn on our farm. They shred the husks and then eat the kernels. Any information you may be able to supply me with will be greatly appreciated." In addition to identifying the beetles, the following information was sent to the correspondent: "This insect has seldom been reported as doing damage in the New England States, but it is a common pest in the Mississippi Valley. The winter is passed in the egg stage in the ground around the roots of corn. They hatch rather late in the spring and the larvae work through the soil until they encounter new roots of corn. If they do not find corn roots they die. They feed upon the corn roots and perhaps to some extent on the roots of native plants,

but their food is chiefly the roots of corn. They burrow through the roots, making small, round tunnels, and become full-grown during July and pupate in cells in the soil. The adults appear late in July and during August, and leave the soil and feed upon silk of corn and the pollen of many kinds of plants. The remedy usually recommended is to practice crop rotation. If corn is not planted on the same field next year, there will be no food for the larvae and the insects die out for lack of food."

[W. E. Britton]

Small Brown Beetles a Nuisance in New Canaan Homes. During the summer of 1934 several small brown beetles, *Coninomus nodifer* Westwood, were sent to the Experiment Station from New Canaan with the information that they came from a home in that town. Later, February, 1937, another species, *Coninomus constrictus* Gyll., was received at this office from the town health officer stating that they were rather abundant in a new house in New Canaan. A visit to the house was made shortly afterward and a few beetles were found, but the lady of the house said that they were very abundant late in the fall. These beetles are known to occur mostly under bark and stones, as in vegetable debris, especially decaying leaves. Some members of this family of beetles (Lathrididae) are also found in drugs and other commercial products. The larvae and their habits are practically unknown. The woman who owned the house was under the impression that when she moved into her new home she brought them from her former residence. None could be found breeding in the house at this time. At a later visit during the summer of 1937 a few beetles were still present but most of them were found outside of the house which was painted white. Apparently the insects were attracted to the house and were entering it through the doors and windows. The beetles were small enough to come through the screens of the windows. The inside of the rooms was painted white so that the few beetles present in the home were easily seen. The beetles were doing no particular harm except that their presence in the home was objectionable to the housewife. [M. P. Zappe]

Infestation of House Crickets. On June 30 many nymphs and adults of the house cricket, *Gryllus domesticus* Linn., were received from Hartford where a considerable number of dwelling houses, some of which had been closed, were heavily infested. A nearby dump was suspected as the source of infestation. This cricket is of European origin and supposedly the "cricket on the hearth", the subject of one of Dickens' stories. In some way it was brought into the United States at an early date, and now occurs sparingly in nearly all of the states east of the Rocky Mountains. In Connecticut it was first observed July, 1918, at Shelton. Since then it has been recorded from New Haven, August 16, 1921, April 14, 1923; Bridgeport, September 8, 1932; and Hartford, June 30, 1937. At the Shelton infestation, July 29, 1918, Mr. Zappe tried two kinds of poisoned bait as follows:

1. Potato flour which had been soiled by the crickets, 8 oz.; borax, 8 oz.; one mashed ripe banana. This was all mixed together and enough water added to make a thin paste.

2. Bichloride of mercury, one tablet dissolved in half a cupful of water; one cupful of flour; the skin of a banana was cut into small pieces and all mixed together.

Two days later, July 31, all of the poisoned bait had been devoured and it was impossible to learn which bait was the more effective. Many of the crickets had been killed but a few were still alive. The occupant of the house continued to use one of these poisoned baits until August 9 and then reported that all the crickets had disappeared. [W. E. Britton]

Melon Worm in Connecticut. A piece of summer crookneck squash was received from Ridgefield, October 30, containing in a burrow a nearly black and decomposed larva of the melon worm, *Diaphania hyalinata* Linn., with the following statement: "Under separate cover I am sending you a piece of crookneck squash with a worm in it that has changed from a brilliant green to what you now see. Both yellow crookneck, straight neck and White Scalloped Bush, squashes were 'bitten' late this season (I would say roughly the last part of September or early in October). It is something I have never before had happen. All my squashes were sprayed though it is possible at the time of the 'biting' there was no residue left. Can you identify this critter for me, give some idea of its life history and the best way to combat it?" The following reply was sent to the correspondent: "Your letter and specimens of October 28 have been received. The crookneck squash was infested by the melon worm, *Diaphania hyalinata* Linn. There are two similar insects, yours being called the melon worm, and *Diaphania nitidalis* Stoll, which is known as the pickle worm. There are no very good remedies for either, except that early-planted cucumbers and summer squashes will escape most of the damage. Sometimes it may be possible to kill some of the adults by spraying the leaves with lead arsenate, and summer squashes may be planted near by as a trap crop. All vines and waste fruits should be gathered and destroyed as soon as the crop is harvested in order to kill the worms that are in them. Little is known about the life history of the melon worm in Connecticut. In North Carolina there are three annual generations. The first brood of caterpillars feeds largely upon the foliage and causes only slight injury to the crop." This insect occurs only rarely in Connecticut and there has been no opportunity to study its life history here. [W. E. Britton]

Lawns Damaged by an Andrenid Bee. On September 20, some Andrenid bees were brought to the Station from West Haven, with a statement that they were nesting in considerable numbers in a lawn, in light sandy soil, and around the entrance to each nest a small mound of sand was thrown out, resembling the work of certain kinds of ants. The following day similar specimens were received from a lawn in the vicinity of Danbury. Specimens of these bees were sent to the Bureau of Entomology and Plant Quarantine, Washington, D. C., where they were identified by specialists as *Andrena asteris* Robt. Mr. Walden visited the West Haven infestation, September 20, and took some photographs. In November photographs of the Danbury infestation, where two lawns were damaged, were received from Mr. James R. Case, County Club Agent of the Fairfield County Farm Bureau. One of these is shown in Figure 28. From the photographs it is apparent that the lawns in Danbury were more heavily infested than that in West Haven. There are many species of Andrena and most of them are burrowers or diggers, and nest in the ground. They are important pollenizers of fruit and vegetable crops, and probably provision their nests with pollen and nectar as food for their young. Certain species seem to select sites where they dig several hundreds or even thousands of nests close

together in the soil. These are called villages. If in a lawn, the sand heaps are quite a nuisance, and remedial measures become necessary. If about a half-teaspoonful of the liquid carbon disulfide, or the granular "Cyanogas" is poured into each burrow just before dark, and the opening closed by stepping on the sand heap, the bees in the nests are killed. It is quite possible that areas of from 20 to 30 square feet may be treated at once by applying the fumigants to a portion of the sand heaps distributed so as to cover the area, and place a rubber cloth over the nests for the night. The

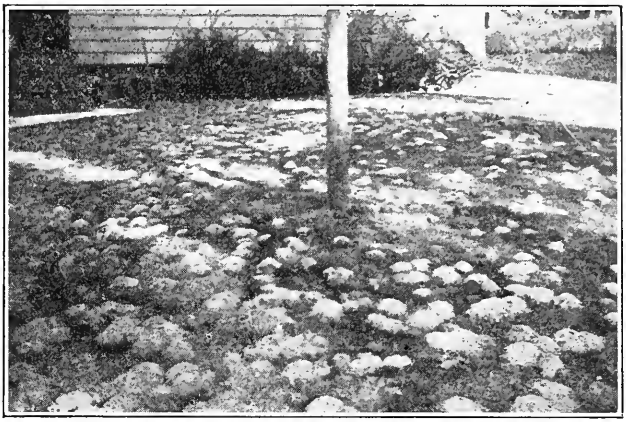

FIGURE 28. Lawn near Danbury, showing heaps of sand, indicating nests of *Andrena asteris*.

next night an adjacent area can be treated and so on until the infested lawn has all been treated. The owner of the West Haven lawn had already treated many of the nests separately with carbon disulfide, and few of these had been reopened. In such treatment the operator must be careful not to spill the carbon disulfide or the "Cyanogas" on the grass, or dead spots will show where the green tissues have been killed. [W. E. BRITTON]

FINANCIAL STATEMENT

Insect Pest Appropriation

July 1, 1936—June 30, 1937

RECEIPTS

Insect Pest Appropriation		$ 44,000.00	
Contribution from peach growers for peach moth parasite work		485.50	
Receipt from nurseryman (penalty for failure to register before July 1)		5.00	
Miscellaneous Receipts:			
Mileage for use of automobile	$16.45		
Sale of anabasine	1.39	17.84	
		$ 44,508.34	
Partial Salary Cut Restoration		3,843.27	
		$ 48,351.61	
Less transfer to Current Expense, June 28, 1937		650.00	
			$47,701.61

DISBURSEMENTS

Salaries	$ 32,171.70	
Labor	8,408.79	
Stationery and office supplies	169.55	
Scientific supplies (chemicals and laboratory supplies)	107.89	
Scientific supplies (spraying and dusting materials)	333.47	
Fertilizers	.90	
Miscellaneous supplies	324.26	
Automobile oil	19.50	
Telegraph and telephone	275.91	
Postage	221.86	
Travel (outlying investigations)	2,259.93	
Travel (meetings, conferences, etc.)	119.10	
Travel (gasoline for automobiles)	242.48	
Transportation of things (freight, express and parcel post)	36.00	
Publications (reprints, etc.)	46.65	
Gas and electricity	288.39	
Water	64.99	
Rent of truck for spraying	27.00	
Storage of apples	80.13	
Insurance (automobile)	181.03	
Furniture, furnishings and fixtures (purchases)	41.25	
Furniture, furnishings and fixtures (repairs)	28.20	
Library (books and periodicals)	268.60	
Library (binding)	83.20	
Scientific equipment (purchases)	632.78	
Scientific equipment (repairs)	25.00	
Automobile repairs	202.91	
Tools, machinery and appliances (purchases)	260.79	
Tools, machinery and appliances (repairs)	172.70	
New buildings and structures	600.00	
Buildings (repairs and alterations)	6.65	
Total disbursements		$47,701.61

PUBLICATIONS, 1937

W. E. Britton

Connecticut State Entomologist. Thirty-Sixth Report. Bul. 396, 127 and vi pp., 34 figs., with index. May, 1937. (Issued August, 1937).

Report of Committee on Injurious Insects. Proc. 46th Annual Meeting, Conn. Pomol. Soc., p. 33. April, 1937.

Report of Experiments with Vegetable Insects. Proc. 24th Annual Meeting, Conn. Veg. Growers Assoc., p. 48. March, 1937.

The Tent Caterpillar. Metropolitan Hartford. (Published by the Hartford Chamber of Commerce). Vol. 22, p. 12. April, 1937.

Concerning Official Common Names for Insects. Jour. Econ. Ent., 30, p. 341, (4 pp.). April, 1937.

Apiary Inspection in 1936. The Connecticut Honey Bee, Vol. 9, p. 2. April, 1937.

Red Tape vs. Research. Jour. Econ. Ent., 30, p. 683. August, 1937.

Apiary Inspection in Status Quo. The Connecticut Honey Bee, Vol. 9, p. 2. October, 1937.

Sixteenth and Seventeenth Biennial Reports of the Commissioners of the State Geological and Natural History Survey. Bul. 59, 24 pp., 1 pl. October, 1937.

W. E. Britton and M. P. Zappe

Inspection of Nurseries, 1936. Reprinted from Bul. 396, pp. 314–323, (10 pp.). (500 copies, issued July, 1937).

Philip Garman

Troublesome Insects of the Orchard. Proc. 46th Annual Meeting, Conn. Pomol. Soc., p. 55. April, 1937.

Notes on Breeding the Apple Maggot, *Rhagoletis pomonella*. In Culture Methods for Invertebrate Animals, p. 436. Comstock Publishing Company, Inc., Ithaca, N. Y. 1937.

Methods of Producing *Macrocentrus ancylivorus* in Large Numbers for Colonization in Peach Orchards. In Culture Methods for Invertebrate Animals, p. 493. Comstock Publishing Company, Inc., Ithaca, N. Y. 1937.

The Peach Moth Situation. In Pomological Pointers for Conn. Fruit Growers. February, 1937.

Some Notes on the Insect Situation. In Pomological Pointers for Conn. Fruit Growers. July, 1937.

W. T. Brigham

Notes on Breeding the Oriental Fruit Moth, *Grapholitha molesta*. In Culture Methods for Invertebrate Animals, p. 345. Comstock Publishing Company, Inc., Ithaca, N. Y. 1937.

J. C. Schread

Methods of Breeding *Perisierola angulata*, a Cocoon Parasite of the Oriental Fruit Moth. In Culture Methods for Invertebrate Animals, p. 512. Comstock Publishing Company, Ithaca, N. Y. 1937.

A New Species of Chalcidoidea (Hymenoptera-Callimomidae) (*Lochites smithi*). Bul. Brooklyn Ent. Soc., XXXII, p. 102. June, 1937. (Issued October, 1937).

J. C. Schread and W. T. Brigham

Six Years Experience with Oriental Fruit Moth Parasites. Proc. 46th Annual Meeting, Conn. Pomol. Soc., p. 37. April, 1937.

Neely Turner

Insecticides to Control the European Corn Borer. Circ. 118, 4 pp., 1 fig. April, 1937.

Relation of State Workers to Commercial Termite Control Companies. Jour. Econ. Ent., 30, p. 94, (4 pp.). February, 1937.

Termite Control. Soap, XIII, p. 101. April, 1937.

Control of European Corn Borer on Dahlias. Spec. Bul. (mimeographed), 2 pp. (500 copies). May, 1937.

Control of Subterranean Termites in Buildings. Exterminators Log, 5, p. 7, (2 pp.). April, 1937.

Control of Some Insects that Damage Wood in Houses. Exterminators Log, 5, p. 11. September, 1937.

NEELY TURNER AND B. H. WALDEN

Some Common Household Insects and Their Control. Bul. 400, 23 pp., 13 figs. September, 1937. (Issued October, 1937).

C. H. BATCHELDER, D. D. QUESTEL AND NEELY TURNER

European Corn Borer Investigations, Experiments with Insecticides on Early Sweet Corn. Bul. 395, 17 pp., 5 figs. June, 1937.

The Tolerance of Sweet Corn to Spreading Agents. E-413, U. S. Bur. Ent. and Pl. Quar. (mimeographed), 11 pp. July, 1937.

R. C. BOTSFORD

Experiences in Mosquito Control in Connecticut. Proc. 24th Annual Meeting, N. J. Mosquito Exterm. Assoc., p. 109. 1937.

R. L. BEARD

A Convenient Field Cage for Individual Insects. ET-111, U. S. Bur. Ent. and Pl. Quar. (mimeographed), 1 p., 4 figs. September, 1937.

B. J. KASTON

The Distribution of Black Widow Spiders. Science, **85**, p. 74. January 15, 1937.

Structural Anomalies in Spiders. Bul. Brooklyn Ent. Soc., XXXII, p. 104. June, 1937. (Issued October, 1937).

The Black Widow Spider in New England. Bul. N. E. Soc. Nat. Hist., No. 85, pp. 3–11, (9 pp., 11 figs.). October, 1937.

B. J. KASTON AND D. S. RIGGS

Studies on the Larvae of the Native Elm Bark Beetle. Jour. Econ. Ent., **30**, p. 98, (10 pp., 7 figs.). February, 1937.

B. J. KASTON AND G. E. JENKS

Dipterous Parasites of Spider Egg Sacs. Bul. Brooklyn Ent. Soc., XXXII, p. 160, (4 pp., 2 pls.). October, 1937.

A. W. MORRILL AND D. S. LACROIX

Experiments on Control of Insects of Tobacco, 1936. In Report of Tobacco Substation at Windsor for 1936. Bul. 391, p. 84, (14 pp., 6 figs.). January, 1937. (Issued May, 1937).

SUMMARY OF OFFICE AND INSPECTION WORK

Insects received for identification	751
Nurseries inspected	388
Regular nursery certificates granted (377 nurseries)	383
Duplicate nursery certificates for filing in other states	136
Miscellaneous certificates and special permits granted	142
Nursery dealers' permits issued	101
Shippers' permits issued to nurserymen in other states	224
Blister rust control area permits issued	180
Certification and inspection of occasional shipments	
Parcels of nursery stock	627
Corn borer certificates	1,307
Packages of shelled corn and other seeds	844
Japanese beetle certificates	
(nursery and floral stock and farm products)	51,584
(soil, sand and manure)	167
Orchards, gardens, fields and lawns examined	134
Buildings examined for termites	99
Shipments of imported nursery stock inspected	14
Number of cases	67
Number of plants	542,975
Apiaries inspected	1,437
Colonies inspected	10,253
Apiaries infested with American foul brood	107
Colonies infested with American foul brood	222

Towns covered by gypsy moth scouts	109
Infestations discovered	536
Egg-clusters creosoted	386,402
Larvae and pupae killed by hand	1,192,069
Infestations sprayed	36
Lead arsenate used (pounds)	83,202
Miles of roadside scouted	3,494
Acres of woodland scouted	698,772
Letters written*	4,652
Circular letters issued	1,083
Bulletins and circulars mailed	4,983
Packages sent by mail and express	190
Post cards mailed	175
Lectures, papers and addresses at meetings	58

ILLUSTRATIONS

The illustrations used as figures in this bulletin are from the following sources: Figures 7, 8, 17, 18, 19 and 20 from drawings by Philip Garman; Figure 21 from drawing by J. F. Townsend; Figures 22 and 23 from drawings by Raimon L. Beard; Figure 16 from photograph by G. L. Walker; Figure 28 from photograph by J. R. Case; all others from photographs by B. H. Walden.

* Includes 85 written from the gypsy moth office at Danielson.

INDEX

Abbot sphinx, 139, 145
Acrobasis juglandis, 140
Acrosternum hilaris, 150
Adalia bipunctata, 149
  humeralis, 149
Adelges abietis, 140, 154
  cooleyi, 141, 154
  cooleyi var. *coweni*, 141
Agrotheureutes hyslopi, 224
Alder blight, 144
Alsophila pometaria, 138, 141, 253
Alypia octomaculata, 144
Amara sp., 150
American cockroach, 147
  foul brood, 164, 165
Ampelophaga choerilus, 150
Anasa tristis, 139, 243
Anatis quindecimpunctata, 150
Andrena asteris, 148, 261
Andricus punctatus, 141
Anobium punctatum, 253
Anomala orientalis, 148
Anthrenus scrophulariae, 147
  verbasci, 147
Antispila nyssaefoliella, 141
Anuraphis roseus, 138
Apanteles militaris, 198
Aphis pomi, 138
Aplodes mimosaria, 150
Apple maggot, 139
    control, 230-232
  redbug, 138
  sprays, tests of, 200-205
Apterophygus sp., 224
Arborvitae leaf miner, 141
  soft scale, 142
Argyresthia thuiella, 141
Armyworm, 137, 139, 191-200
Ascia (*Pontia*) *rapae*, 139
Ash flower gall, 142
Asiatic beetle, 148, 189
  garden beetle, 138, 139, 145, 148, 189
Asparagus beetle, 139
Aspidiotus abietis, 141
  perniciosus, 138
  tsugae, 141
Asterolecanium variolosum, 141
Attagenus piceus, 147
Autographa brassicae, 139
Automeris io, 150
Autoserica castanea, 138, 139, 145, 148

Bagworm, 144
Barberry webworm, 145
Barium fluosilicate, 221
Basic copper sulfate, 202
  zinc arsenate, 221
Basilarcha astyanax, 150
Bassus diversus, 222, 223, 224
Beaked willow gall, 143
Bedbug, 149
Belvosia unifasciata, 198
Birch leaf-mining sawfly, 142
Black carpenter ant, 148
    carpet beetle, 147
    -headed pine sawfly, 143
    vine weevil, 144
Blatta orientalis, 147
Blattella germanica, 147
Blissus hirtus, 148
Book-louse, 147
Bordeaux spray, 202
Boxwood leaf miner, 145
Brachyrhinus ovatus, 147
  sulcatus, 144
Broad-horned prionus, 144, 148
Brown-tail moth, 173
Bucculatrix sp., 141
Buckeye butterfly, 151
Bulb mite, 146
Bumble flower beetle, 138

Cabbage looper, 139
    maggot, 137, 140
    worm, 139
Cacoecia argyrospila, 138
Calcium arsenate, 198, 230
Callidium sp., 148
Calomycterus setosus, 145
Calosoma scrutator, 150
Camponotus herculeanus pennsylvanicus, 148
Campoplex sp., 224
Canker worm, 137
    fall, 138, 141, 253
    spring, 253
Carpet beetle, 147
Carpocapsa pomonella, 138
Cartodere costulata, 147
Catalpa midge, 142
Caterpillar hunter, 150
Caulacampus (*Priophorus*) *acericaulis*, 141
Cecidomyia serotinae, 141
Cedar rust, 204, 205
Centeter cinerea, 189, 190, 191
Ceratomia amyntor, 141
Ceutorhynchus cyanipennis, 150
Chauliodes angusticollis, 150
Chilocorus bivulnerus, 150
Chinese mantid, 137, 150
Chionaspis americana, 141
  euonymi, 144
  pinifoliae, 141, 205
Cicada killer, 149
Cigarette beetle, 146
Cimex lectularius, 149
Cirphis unipuncta, 137, 139, 191
Clavate tortoise beetle, 139
Codling moth, 138, 201-204
Coleophora laricella, 141
Colorado potato beetle, 140
Confused flour beetle, 147

Coninomus constrictus, 147, 260
nodifer, 260
Conopia (Sesia) acerni, 141
exitiosa, 138, 256
Conotrachelus nenuphar, 138
Copidosoma sp., 224
Corn ear worm, 140
root worm, 139, 259
Corydalis cornuta, 150
Corythucha arcuata, 141
ciliata, 141
ulmi, 141
Catalpa lanigera, 150
Crabro sp., 215
Creosote, 209, 212, 214, 215, 217
Cressonia juglandis, 150
Crioceris asparagi, 139
Cryolite, 221, 230
Ctenocephalides canis, 149
Cubé, 181, 182, 218, 227, 228
Culex pipiens, 149
Curculio, 201-204
Cutworms, 139
Cyclamen mite, 146
Cyllene caryae, 141

Dark meal worm, 146
Dasyneura communis, 141
pyri, 138
Datana integerrima, 141
major, 144
ministra, 138
Death-watch beetle, 148
Deloyala clavata, 139
Dendroleon obsoletum, 150
Dermacentor variabilis, 149, 254
Dermestes cadaverinus, 147
lardarius, 147
Deronyia umbrina, 150
Derris, 181, 232, 258
Diabrotica duodecimpunctata, 146, 257
longicornis, 139, 259
vittata, 139, 243, 257
Diacrisia virginica, 150
Diamond-back moth, 140
Diaphania hyalinata, 139, 261
nitidalis, 261
Diapheromera femorata, 141
Diaspis carueli, 142
Dibrachys boucheanus, 223, 224
Dichelonyx elongata, 142
Dichomeris marginellus, 144
Dioctes molestae, 222-225
Diprion polytomum, 142
simile, 142
Dobson fly, 150
Dog flea, 149
tick, 149, 254
Dogwood club gall, 142
Dormant oil, 219, 220
Drone fly, 150
Drugstore beetle, 146
Dryophanta palustris, 142
Dual-fixed nicotine dust, 181

Eastern field wireworm, 140, 255
Eight-spotted forester, 144
Elm borer, 144
insects, check list of, 235-242
lacebug, 141
leaf beetle, 142
leaf miner, 142
scurfy scale, 141
spanworm, 142
Emphytus cinctus, 163
Empoasca fabae, 138, 139, 252
Enchenopa binotata, 150
Ennomos subsignarius, 142
Ephialtes aequalis, 224
Epicauta marginata, 139
Epilachna varivestis (corrupta), 137, 140
Epinotia signatana, 142
Epitrix cucumeris, 140
Epyris sp., 224
Eriophyes fraxiniflora, 142
padi, 142
pyri, 138
ulmi, 142
Eriosoma americana, 142
Eristalis tenax, 150
Eubadizon pleurale, 224
Eugenol, 186
Eulia velutinana, 138
Euonymus scale, 144
Eupelmus momphae, 224
Euphoria inda, 138
European corn borer, 137, 140, 146, 180-184
elm scale, 142
fruit scale, 142
pine shoot moth, 144, 154
red mite, 138, 200, 203
control, 219-220
spruce sawfly, 142
Eurytoma sp., 224

Fall webworm, 137, 142
Fenusa pumila, 142
Fish oil, 200-204, 220, 221, 230
Fixed nicotine, 227
Fleas, 137
Flotation sulfur, 219-221, 230
Forest tent caterpillar, 137, 143
Formica fusca subsericea, 144
Four-horned sphinx, 141
-lined plant bug, 145, 146
Fruit tree leaf roller, 138
Fucellia maritima, 150
Fumea casta, 150
Furniture beetle, 253

Galerucella xanthomelaena, 142
Garden millipede, 148
Gasteruption sp., 150
Geraniol, 186
German cockroach, 147
Giant garden slug, 146
water bug, 151
Gladiolus thrips, 137, 146

Glischrochilus fasciatus, 151
Glue, Casein waterproof, 204, 221, 232
Glypta rufiscutellaris, 224
Goldsmith beetle, 150
Gonatopus sp., 224
Gordius robustus, 151
Gossyparia spuria, 142
Gouty oak gall, 141
vein midge, 141
Gracilaria syringella, 145
Grape phylloxera, 139
Grapholitha molesta, 137, 138
Grapta interrogationis, 142
Gray hair-streak butterfly, 152
Green apple aphid, 138
clouded swallow-tail butterfly, 151
elm beetle, 142
stink bug, 150
Gryllus domesticus, 147, 260
Gypona sp., 145
Gypsy moth control, 171-179

Hagenius brevistylus, 151
Hairy chinch bug, 148
Haltica ulmi, 142
Hamadryas antiopa, 142
Haploa clymena, 151
Heliothis obsoleta, 140
Hellgramite, 150
Hemerocampa leucostigma, 142
Heteropoda venatoria, 149
Hickory bark beetle, 144
borer, 141
soft scale, 142
Holly leaf miner, 145
Hoplia trifasciata, 138, 257
Hormaphis hamamelidis, 145
House cricket, 147, 260
or rain barrel mosquito, 149
Huntsman spider, 149
Hylemyia brassicae, 137, 140
cilicrura, 140
Hylobius pales, 142
Hyperaspis signata, 150
Hyphantria cunea, 137, 142

Illinoia pisi, 140
solanifolii, 140
Imported willow leaf beetle, 144
Indian-meal moth, 146
Inspection of apiaries, 164-170
imported nursery stock, 163
nurseries, 154-162
Introduced pine sawfly, 142
Io moth, 150
Iris borer, 146
Isadelphus smithii, 224
Itonida catalpae, 142
Itycorsia sp., 142
Ixodes hexagonus var. *cookei*, 254

Japanese beetle, 137, 146, 149, 185-191
Julus hortensis, 148
Juniper scale, 142
webworm, 144
Junonia coenia, 151

Kaliofenusa ulmi, 142
Kerosene emulsion, 206, 207
extract of pyrethrum, 243, 244, 248

Ladybeetle, fifteen-spotted, 150
twice-stabbed, 150
two-spotted, 149
Larch case bearer, 141
Larder beetle, 147
Lasioderma serricorne, 146
Lasioptera clavula, 142
Lasius sp., 147, 148, 215
Laspeyresia prunivora, 138
Lead arsenate, 188, 189, 194, 198, 200-204, 219-221, 229, 230, 232-234, 257, 258, 261
Lebia viridis, 150
Lecanium caryae, 142
corni, 142
fletcheri, 142
Leopard moth, 144
Lepidosaphes ulmi, 143, 145
Leptinotarsa decemlineata, 140
Lesser apple worm, 138
Lethocerus americanus, 151
Light-loving grapevine beetle, 140, 146
Lilac borer, 145
leaf miner, 145
Limax maximus, 146
Lime sulfur, 200, 201, 203, 204, 206, 207, 219, 220, 232-234
Limonius (*Pheletes*) *ectypus*, 140, 255
Lunate long-sting, 150
Lygidia mendax, 138
Lygus quercalbae, 254
Lygus, sp., 138

Macremphytus sp., 145
Macrocentrus ancylivorus, 222-224, 226
Macrodactylus subspinosus, 138, 143, 145, 258
Macronoctua onusta, 146
Magicicada (*Tibicen*) *septendecim*, 137, 151, 248
Malacosoma americana, 137, 138, 143, 255
disstria, 137, 143
Maple bladder gall, 143
callus borer, 141
leaf stem borer, 141
trumpet skeletonizer, 142
Margined blister beetle, 139
Mealybug, 255
Megarhyssa lunator, 150
Melanotus sp., 140, 255
Melittia satyriniformis, 140, 243
Melon worm, 139, 261
Mexican bean beetle, 137, 140
Microweisia misella, 150
Monarthropalpus buxi, 145

Monarthrum fasciatum, 143
Mosquito control, 250-252
Mourning cloak butterfly, 142
Museum beetle, 147
Myrmeleon immaculatus, 151

Nacerda melanura, 257
Nacophora quernaria, 143
Necrophorus americanus, 151
pustulatus, 151
Neoclytus acuminatus, 143
Neodiprion lecontei, 143
pinetum, 143
Neoprociphilus aceris, 143
Neuroterus batatus, 143
papillosus, 143
Nicotine, 219, 243
sulfate, 218
tannate, 181
Nodonota puncticollis, 146

Oak blister wasp, 143
lacebug, 141
plant bug, 254
potato gall, 143
Ochrosidia villosa, 137, 149, 189, 254
Odontaeus filicornis, 149
Odontocorynus scutellum-album, 146
Omphalocera dentosa, 145
Onion thrips, 137, 140
control, 218-219
Orange dog butterfly, 151
Orgilus longiceps, 222
Oriental cockroach, 147
fruit moth, 137, 138
control, 227-228
parasite work, 222-227
Orthodichlorobenzene, 210
Orthosia bicolorago var. *ferruginoides*, 151
Oryzaephilus surinamensis, 146
Osmoderma eremicola, 143
Otacustes sp., 224
Oyster-shell scale, 143, 145, 154

Pachystethus lucicola, 140, 146
Paederus litorarius, 151
Paleacrita vernata, 253
Pales weevil, 142
Panchlora cubensis, 151
Pandorus sphinx, 145
Paonias excaecatus, 151
Papilio glaucus var. *turnus*, 151
thoas (*cresphontes*), 151
troilus, 151
Paralechia pinifoliella, 143
Paratetranychus pilosus, 138
ununguis, 143
Parcoblatta virginica, 147
Paria (*Typophorus*) *canella*, 138, 258
Paris green, 198, 210, 212
Pavement ant, 147
Pea aphid, 140
Peach borer, 138, 256
Pear leaf blister mite, 138
psylla, 139
Pediculoides ventricosus, 222
Pegomyia hyoscyami, 140
Pelidnota punctata, 138
Pemphigus ulmifusus, 142
Periodical cicada, 137, 151, 248, 249
Periplaneta americana, 147
Perisierola angulata, 226
Phaeogenes haeussleri, 222, 223
Phenacoccus acericola, 143
Phidippus audax, 149
Phinotas oil, 211, 213, 215, 216
Pholus pandorus, 145
Phyllocoptes quadripes, 143
schlechtendali, 139
Phyllophaga fusca, 257
tristis, 139, 149, 252
sp., 143
Phylloxera caryae-globuli, 143
vitifoliae, 139
Phymatodes variabilis, 143
Phytomyza ilicis, 145
minuscula, 146
Phytophaga rigidae, 143
Pickle worm, 261
Pine bark aphid, 143
blister rust, 154
leaf scale, 141, 154, 205-207
tube moth, 143
Pineus strobi, 143
Pissodes strobi, 144
Pit-making oak scale, 141
Plagiodera versicolora, 144
Pleurophorus caesus, 149
Pleurotropis tarsalis, 151
Plodia interpunctella, 146
Plum curculio, 138, 221
Plutella maculipennis, 140
Podabrus rugulosus, 151
Podosesia syringae, 145
Poecilocapsus lineatus, 145, 146
Poecilonota cyanipes, 144
Polydrusus sericeus, 151
Polygria sp., 149
Popillia japonica, 137, 146, 149
Poplar canker, 154
Potato aphid, 140
flea beetle, 140
leafhopper, 138, 139, 252
Powder-post beetle, 148
Prionus laticollis, 144, 148
Prociphilus tessellatus, 144
Proteoteras moffatiana, 144
Protoparce (*Phlegethontius*) *quinque maculata*, 140, 255
sexta, 255
Protosphex ichneumonea, 149
Pseudocneorrhinus setosus, 145
Pseudococcus cuspidatae, 256
kraunhiae, 255
sp., 144, 145
Pseudolucanus capreolus, 148
Psyllia pyricola, 139
Ptecticus trivittatus, 151

Ptinus fur, 146
Purple butterfly, 150
Pyrausta nubilalis, 137, 140, 146
Pyrethrum, 244, 247, 248, 257

Quebracho tannin, 227

Red-banded leaf roller, 138
-headed pine sawfly, 143
-humped caterpillar, 139
spider, 146
Reticulitermes flavipes, 148
Rhabdophaga batatus, 144
Rhagium lineatum, 148
Rhagoletis pomonella, 139
Rhizoglyphus hyacinthi, 146
Rhododendron borer, 145
lacebug, 145
Rhyacionia buoliana, 144
Riphicephalus sanguineus, 149, 254
Rose chafer, 138, 143, 145, 258
leaf beetle, 146
Rosy apple aphid, 138
Rotenone, 230-232, 243, 257
Round-headed apple borer, 145

Sacbrood, 165
Saddle-back caterpillar, 140, 146, 151
Sagaritis sp., 224
San José scale, 138, 154
Saperda candida, 145
tridentata, 144
Satin moth, 144
Saw-toothed grain beetle, 146
Scab, 201-204, 220
Scambus pterelas, 224
Scenopinus fenestralis, 151
Scheloribates lanceoliger, 151
Schinia arcifera, 151
Schizura concinna, 139
Scolothrips sp., 219
Scolytus quadrispinosus, 144
rugulosus, 139
sulcatus, 139
Scymnus flavifrons, 150, 151
Seed corn maggot, 140
Seius sp., 219
Sesia rhododendri, 145
Shot-hole borer, 139
Sibine stimulea, 140, 146, 151
Silpha americana, 151
Silverfish, 147
Sitka spruce gall aphid, 141
Sitodrepa panicea, 146
Slippery elm pouch gall, 142
Sodium arsenite, 198, 212
oleyl sulfate, 243
Solenius sp., 148, 258, 259
Sooty blotch, 201-203
Sour gum leaf miner, 141
Southern corn root worm, 257
Sowbug, 151, 215
Sphecius speciosus, 149
Sphecodina abbotii, 139, 145
Spinach leaf miner, 140
Spiny elm caterpillar, 142, 150
Spirobolus platylops, 151
Spotted cucumber beetle, 146, 257
grapevine beetle, 138
Springtail, 139, 149
Spruce gall aphid, 140, 154
mite, 143
Squash borer, 140
bug, 139
control, 243-248
vine borer, 243, 247
Stag beetle, 148
Stephanitis rhododendri, 145
Stephanopachys rugosus, 148
Stethorus punctum, 219
Stilpnotia salicis, 144
Strawberry leaf roller, 222
Striped cucumber beetle, 139, 243, 257
Succulent oak gall, 142
Sulfur, 200-204, 218-220
catalytic, 201
dritomic, 201
dry wettable, 203, 204, 221
micronized, 204
Sycamore lacebug, 141

Taeniothrips simplex, 137, 146
Tar oils, 219
Tarpela micans, 152
Tarsonemus pallidus, 146
Telephanus velox, 152
Tenebrio obscurus, 146
Tenodera sinensis, 137, 150
Tent caterpillar, 137, 138, 143, 255
Termite, eastern subterranean, 148
control, 208-217
Terobia sp., 224
Tetralopha robustella, 144
Tetramorium caespitum, 147
Tetranychus bimaculatus, 146
Thrips tabaci, 137, 140, 218
Thyridopteryx ephemeraeformis, 144
Tibicen caniculatus, 149
Tiger swallow-tail butterfly, 151
Tineola biselliella, 147
Tiphia popilliavora, 189, 190
vernalis, 189, 190
Tipula trivittata, 152
Tobacco worm, 140, 255
Tolype velleda, 152
Toumeyella liriodendri, 144
Tribolium confusum, 147
Trichogramma, 222, 224-226, 228-230
Trifidaphis phaseoli, 140
Troctes divinatoria, 147
pulsatoria, 147
Tulip tree scale, 144
Two-marked treehopper, 150
Typhaea fumata, 258
Typhlocyba pomaria, 139

Uranotes melinus, 152

Violet-tip butterfly, 142
Virgin tiger moth, 150

Walkingstick, 141
Walnut caterpillar, 141
  sphinx, 150
Webbing clothes moth, 147
White apple leafhopper, 139
  arsenic, 198
  -marked spider beetle, 146
  -marked tussock moth, 142
  pine weevil, 144, 154
Wild cherry bud gall, 141
  cherry pouch gall, 142
Willow potato gall, 144
Winthemia quadripustulata, 196, 198
Wireworms, 140, 255
Woolly elm aphid, 142
  maple aphid, 143
  maple leaf scale, 143

Xestobium rufovillosum, 148
Xylotrechus colonus, 144

Yellow-necked caterpillar, 138

Zetes eliminatus, 152
Zeuzera pyrina, 144
Zinc sulfate, 202, 221