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CONNECTICUT STATE ENTOMOLOGIST
FORTIETH REPORT
1940

R. B. FRIEND, Ph.D.
State Entomologist

Connecticut
Agricultural Experiment Station
New Haven

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

I have the honor to transmit, herewith, the fortieth report of the State Entomologist. This gives an account of the activities of the Department of Entomology, both regulatory, as prescribed by Statute, and research, for the year ending October 31, 1940. In addition to the accounts of progress in research given in this report, members of the Department have published several papers in journals, bulletins, circulars, etc., a list of which is appended.

Respectfully submitted,

R. B. FRIEND,
State and Station Entomologist.

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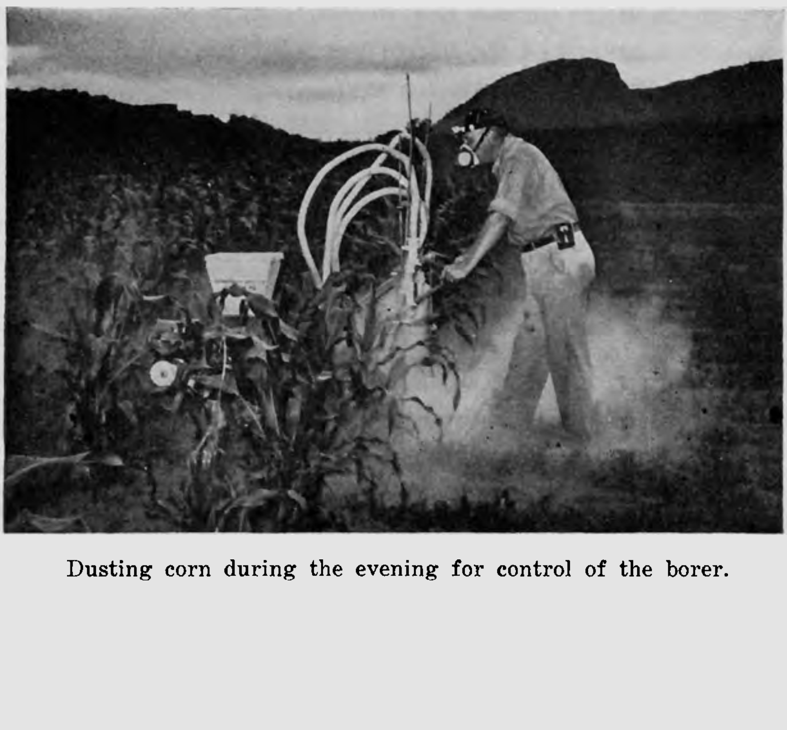

Dusting corn during the evening for control of the borer.

CONNECTICUT STATE ENTOMOLOGIST

FORTIETH REPORT

1940

R. B. Friend

INSECT RECORD FOR 1940

THE Japanese beetle (*Popillia japonica* Newm.) is increasing in abundance in the State and will probably so continue for the next few years. It is already a serious pest in certain towns and has been very injurious to ornamental trees and shrubs, vineyards, and at least one orchard. The insect is most abundant in and around Hartford and in Branford, New Haven, Hamden, Bridgeport, and Greenwich.

The gypsy moth (*Porthetria dispar* L.) caused no noticeable defoliation of trees during 1940, although present in much of the State. The severe outbreaks in the Granby-Simsbury area and on the Southbury-Roxbury line, where extensive control operations were carried out in 1939, have subsided to an innocuous level.

The elm leaf beetle (*Galerucella luteola* Muller) was unusually abundant and injurious to elms. Large numbers of trees were completely defoliated.

A geometrid caterpillar (*Ellopia athasaria* Walker) defoliated hemlock stands in Woodbridge and Branford.

A grasshopper (*Melanoplus punctulatus* Uhler) defoliated numbers of small white pines in plantations in Rainbow and Branford.

The Dutch elm disease has continued to spread, and infected trees were discovered in 17 new towns in Litchfield, Fairfield, and New Haven counties, and in one town, Preston, in New London County. *Scolytus multistriatus* Mars., the principal vector, has never been found in Preston.

The apple maggot (*Rhagoletis pomonella* Walsh) was very abundant and injurious.

A disconcertingly severe outbreak of the codling moth (*Carpocapsa pomonella* L.) occurred in an orchard in Middlefield.

Injury to the peach crop by the Oriental fruit moth (*Grapholitha molesta* Busck) was somewhat greater than in 1939.

The red-banded leaf roller (*Argyrotaenia velutinana* Walk.) was less abundant than in 1939.

Pears in an orchard in Fairfield County were infested with mealybugs (*Pseudococcus comstocki* Kuw.). This pest has not previously been found on fruit in the State, although it has injured apples in Virginia in recent years.

The European corn borer (*Pyrausta nubilalis* Hubn.), although not generally so abundant as in 1939, severely injured the corn crop. Investigators of the Federal Bureau of Entomology and Plant Quarantine estimated the loss in Connecticut in 1940 due to this borer at approximately $43,000 and $416,000 to grain corn and sweet corn, respectively.

The European earwig (*Forficula auricularia* L.) was fairly common in a restricted locality in New Haven.

The pine mouse (*Pitymys pinetorum*) and meadow mouse (*Microtus pennsylvanicus*) populations in the State were generally rather low during the year.

During 1940, 576 samples of insects were received at this office about which information was desired. These are classified under the following economic groups:

Specimens Received — 1940

Fruit pests	31
Field, vegetable, and truck crop pests	11
Forest and shade tree pests	173
Pests of shrubs and vines	32
Flower and greenhouse pests	29
Household and stored food products pests	97
Timber and wood products pests	74
Soil and grassland inhabiting pests	48
Insects annoying man and domesticated animals	15
Parasitic and predaceous insects	20
Miscellaneous	46
	576

This list does not show the relative abundance or economic importance of the different groups in the year's survey of the insect pests of the State. Many of these insects are sent in by residents of the urban sections of the State who do not have direct contact with members of the department, while many of the farmers, fruit growers, and market gardeners may obtain their information direct from department members when examining their crops or attending local gatherings of these various groups.

Termites or their work, as in the past six years, head the list, having been sent in 29 times from 21 different localities. The elm leaf beetle was received 24 times from 19 different localities. Many of the specimens were hibernating adults from houses, indicating early in the spring that the pest was widespread and would probably cause more than the average amount of injury to elms. The black carpet beetle, an important household pest of woolens, was next on the list, with 22 records. Carpenter ants were sent in 15 times. The spruce mite, which often injures the foliage of a variety of ornamental evergreens, was received 11 times. Japanese beetle adults and grubs were represented by 9 lots. There were 8 samples of euonymus scale, an injurious pest especially of the evergreen vine, *Euonymus radicans,* on which it is difficult to control.

The following insects were each received five or six times:

Calomycterus setarius Roelofs, an introduced weevil which is especially troublesome due to its habit of crawling into houses. This insect, previously reported from Fairfield and Litchfield counties, was received in 1940 from Farmington and West Hartford in Hartford County.

The pine leaf scale, *Chionaspis pinifoliae* Fitch, a conspicuous pest on the needles of various ornamental pines.

Tulip tree scale, *Toumeyella liriodendri* Gmel., one of our largest scale insects, which attacks the tulip tree.

Phymatodes variabilis Fabr., a long-horned beetle often found emerging from firewood in basements.

Bladder maple gall, *Phyllocoptes quadripes* Shim., a conspicuous mite gall on soft maples.

Gouty maple gall, *Dasyneura communis* Felt, a midge gall on sugar maple.

Tetralopha robustella Zell., a moth, the larvae of which produce conspicuous frass masses on pine.

Birch leaf-mining sawfly, *Fenusa pumila* Klug, abundant on gray and white birch.

Pavement ant, *Tetramorium caespitum* L., frequently a pest in houses.

Cicada killer, *Sphecius speciosus* Drury.

Chinese praying mantid, *Paratenodera sinensis* Sauss.

In addition to these insects, about which individuals requested information regarding control methods, over 50 species of insects have been identified for amateur collectors.

The Station insect collection now contains about 7,500 species. The most important recent additions have been a number of parasitic Hymenoptera and between 3,000 and 4,000 specimens of Connecticut Lepidoptera. The Lepidoptera were donated by Mr. Harry L. Johnson of South Meriden, who has so generously contributed to our collection in the past.

CONFERENCE OF CONNECTICUT ENTOMOLOGISTS

The seventeenth annual conference of Connecticut Entomologists was held at the Massachusetts Agricultural Experiment Station Field Station at Waltham, Massachusetts, December 13, 1940, at the invitation of Professor W. D. Whitcomb. Professor Whitcomb was elected chairman, and 50 persons registered. The program was as follows:

NOTES ON CODLING MOTH AND APPLE MAGGOT IN CONNECTICUT.
Philip Garman, New Haven, Conn.

NOTES ON THE CHINCH BUG. J. P. Johnson, New Haven, Conn.

THE PLACE OF STATISTICS IN ENTOMOLOGICAL RESEARCH.
C. I. Bliss, New Haven, Conn.

SOME INSECT PESTS OF ONIONS IN THE CONNECTICUT VALLEY.
A. I. Bourne, Amherst, Mass.

THE PRESENT STATUS OF THE EUROPEAN SPRUCE SAWFLY IN THE UNITED STATES. P. B. Dowden, New Haven, Conn.

BIOLOGICAL CONTROL OF THE JAPANESE BEETLE.
C. H. Hadley, Moorestown, N. J.

HOMOPTERA OF NEW ENGLAND — A SUMMARY AND SUGGESTIONS FOR FUTURE INQUIRY. C. H. Blake, Cambridge, Mass.

CRANBERRY INSECTS. H. J. Franklin, East Wareham, Mass.

THE APPLE LEAF-CURLING MIDGE. W. D. Whitcomb, Waltham, Mass.

INSPECTION OF NURSERIES, 1940

M. P. Zappe

THE annual inspection of nurseries started on July 1, 1940, as required by Section 2136 of the General Statutes. The writer, assisted by Messrs. A. F. Clark, W. T. Rowe and R. J. Walker, inspected all the larger nurseries during July and August. The smaller ones were inspected in September, and Mr. L. A. Devaux assisted for a few days during this month. All regular inspection was completed by the end of the month. Several of the nurseries were reinspected to check on the eradication of pests. Most of the nurseries were in good condition but a few which do not carry on a very active business were rather neglected.

Altogether, 96 different insect pests and 52 plant diseases were found in the nurseries during the inspection period of 1940. Most of them, however, were of minor importance. San José scale is very scarce at the present time, perhaps due to the fact that most of the nurseries that handle fruit stock burn up their surplus stock at the end of the selling season rather than keep it for a number of years. Spruce gall aphids were slightly more abundant than last year. European pine shoot moth continues to be a troublesome pest, especially in the southwestern part of the State. Pine leaf scale was about as abundant as last year. The presence of "X" disease of peach was detected in one block of peaches, and these trees were immediately destroyed. The stringent regulations under which peach stock is grown should completely eradicate this trouble from nurseries.

Some of the more important pests that may be carried on nursery stock, with the number of nurseries infested by each for the past 10 years, are shown in the following table:

Table 1. Ten-Year Record of Certain Nursery Pests

Pest	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Oyster-shell scale	73	68	78	104	93	87	84	53	49	57
San José scale	11	10	13	19	17	11	8	2	1	2
Spruce gall aphids[1]	124	141	231	244	285	337	306	312	216	231
White pine weevil	74	70	61	67	98	82	101	97	93	70
Pine leaf scale	20	26	46	66	42	72	60	25	50	48
European pine shoot moth	32	77	137	120	121	108	128	130	110	108
Poplar canker	23	40	34	39	28	28	26	20	14	15
Pine blister rust	13	12	11	7	2	0	4	5	3	3
Nurseries uninfested	32	24	22	21	16	26	25	32	19	33
Number of nurseries	327	351	362	381	373	380	377	402	399	376

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

Number and Size of Nurseries

The list of nurserymen for 1940 contains 376 names, a decrease of 23 since 1939. A classification of nurseries by size is given in the following table.

Area	Number	Percentage
50 acres or more	19	5
10 acres to 49 acres	47	12
5 acres to 9 acres	34	9
2 acres to 4 acres	94	25
1 acre or less	182	49
	376	100

Of the 376 nurseries listed for 1940, three 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 was granted two certificates during the year.

Thirty-four nurserymen failed to register before July 1, 1940, and, as provided by Section 2137 of the General Statutes, were charged for the cost of inspection, a minimum of $5.00 in each case. All but 10 have paid the inspection fee, and $120 has been turned over to the Treasurer of the Station to be sent to the State Treasury.

The area of Connecticut nurseries receiving certificates in 1940 is 4,859 acres, an increase of 26 acres since 1939. Altogether 11 new nurseries have been added, and 34 have discontinued business either temporarily or permanently since last year. Some of these registered late and were inspected but refused to pay the cost of inspection as required by the General Statutes. Therefore, they were not issued certificates and cannot legally sell their stock. A few nurseries listed in 1939 are on the 1940 list under different names, thus changing the alphabetical arrangement. The nursery firms receiving certificates in 1940 are as follows:

Connecticut Nursery Firms Certified in 1940

Name	Address	Acreage	Certificate Number
Adamcyk, Frank	Deep River	1	7155
Adamec Evergreen Nursery, George	East Haven	1	6075
Aldrich, Edward	Guilford	1	6024
Aldrich, Miss Inie E.	Plymouth	1	6009
Allen, Henry L.	Pawcatuck	1	7152
Amato, Rose	Cromwell	2	4840
Andover Gardens	Andover	1	5934
Anstett Nursery, Louis	Norfolk	2	6019
Artistree Nursery	Branford	3	6031
Austin, Jr., Irving M.	Glenville	2	6054
Austin, Mrs. Charles	Yalesville	1	6031
Backiel, Adolf	Southport	1	6037
Bailey's Nursery, Ralph	West Cornwall	1	5938
Bakhmeteff, Boris A.	Brookfield	10	6047
Banak Nurseries	New Britain	4	6018
Banigan, R. D.	Danielson	4	4837

Name	Address	Acreage	Certificate Number
Barnes Bros. Nursery Co., The	Yalesville	200	5922
Barton Nursery	Hamden	1	7199
Beach, Roy G.	Forestville	1	4836
Beattie, W. H.	New Haven	1	7159
Bedford Gardens	Plainville	1	6034
Bedini, Vincent	Ridgefield	3	7126
Beran Landscape-Developers-Florists	New London	1	7181
Berg, Fred	Stamford	4	7125
Berkshire Gate Nurseries	Danbury	1	4842
Bertolf Brothers	Old Greenwich	40	5953
Biehler, Mrs. Augusta	Plainville	1	6051
Blue Hills Nurseries, Inc.	Avon	30	4887
Boggini Nursery, L.	Manchester	1	6042
Bollerer, F. G., Anderson Ave. Nursery	West Haven	1	6096
Bonnie Brook Gardens	Rowayton	2	6014
Booy, H. W.	Yalesville	4	6039
Boschen, Goerge E.	West Haven	1	7142
Brack Nursery	New Milford	3	5930
Brainard Nursery & Seed Company	Thompsonville	16	4899
Branford Nurseries	Branford	6	7190
Bretschneider, A.	Danielson	1	6030
Bridgeport Hydraulic Company	Bridgeport	15	5961
Brimfield Gardens Nursery	Wethersfield	8	6027
Bristol Nurseries, Inc.	Bristol	65	4841
Brookfield Nurseries, Inc.	Brookfield	3	7189
Brooklawn Conservatories	Bridgeport	1	5915
Brooklawn Nursery	Bridgeport	1	7166
Brookside Nurseries	Darien	5	4892
Brouwer's Nurseries	New London	25	5964
Brouwer Nursery, Jack	New London	10	6081
Brouwer's Nurseries, Peter	New London	4	6073
Burnett's Corners Farm, The	Groton	2	4855
Burnside Avenue Greenhouse & Nursery	East Hartford	4	6000
Burr, Morris L.	Westport	1	6059
Burr & Co., Inc., C. R.	Manchester	500	7111
Byram Nursery	East Port Chester	1	7198
Candlewood Nursery	Danbury	1	5949
Cannavo, Tony	Winsted	1	4880
Cardarelli, E. J.	Cromwell	5	4872
Cascio Nursery, The Peter	West Hartford	15	5917
Case Company, Inc., The	Ridgefield	1	4869
Centerbrook Landscape Service (2)	Centerbrook	1	5960
Charlie's Stand	East Hartford	1	7185
Cherry Hill Gardens	Waterbury	1	4831
Cherry Hill Nursery, Inc.	Rockfall	15	5987
Chiapperini & Sons, Michele	Groton	2	6089
Child's Gardens	Kent	1	4868
Chippendale Nurseries, Inc.	Old Lyme	2	7140
Choate School, The	Wallingford	4	6044
Chudy, Peter	Danbury	1	7153
Clark, Arthur H.	Yalesville	1	7148
Cleary's Gardens	Bethel	1	7106
Clinton Nurseries	Clinton	60	4867
Clyne Nursery & Florist	Milldale	1	5972
Coley, H. W.	Westport	1	7192
Compton, Margaret	Norwalk	2	7171
Conine Nursery Co., Inc.	Stratford	75	5967
Conn. Agr. Expt. Station (W. O. Filley, Forester)	New Haven		5973

Name	Address	Acreage	Certificate Number
Connecticut Forestry Nurseries	Deep River	15	7143
Connecticut State Forestry Dept.	Hartford	8	5998
Connecticut State Highway Dept.	Hartford	18	7119
Connecticut Valley Nurseries	Manchester	39	7112
Cooke, C. W.	Branford	1	5955
Cronamere Alpine Nurseries, Inc.	Greens Farms	5	5923
Cylkowski, B.	Simsbury	2	5944
Daisy Hill Gardens	Derby	1	4889
Damen, Peter J.	East Haven	2	4850
Daniel, Joseph	Bridgeport	1	5916
Davis Gardens	Ansonia	1	5900
Daybreak Nurseries	Westport	3	7202
DeMars Nursery	Winsted	1	4885
Dewey, V. E.	Groton	2	7204
Dietrich Nursery, Benjamin	Greenwich	4	5978
Dillon, Thomas	Greenwich	1	7135
Dingwall, Joseph N.	West Haven	1	7186
Doane, David F.	Haddam	1	7133
Dobel, Paul	Union City	1	7196
Donovan, Daniel	Talcottville	1	5926
Donovan, John N.	Rocky Hill	3	6010
Drenckhahn, Ernest J.	Cos Cob	10	7208
Dunlap's Dollar Evergreens	Cromwell	3	7164
Dunn, John	Danbury	1	6005
Eager, Edward M.	Bridgeport	1	4849
East Haven Nursery	East Haven	1	5969
Elfgren Nurseries	East Killingly	3	5925
Ellington Evergreen Nursery	Ellington	2	7178
Elliott, Jesse M. & Grace E.	Litchfield	1	7109
Ellmer, Karl	Cannondale	5	7139
Ellsworth Nursery	Newington	1	7151
Elm Grove Cemetery Association	Mystic	1	5997
Evergreen Nursery Co., The	Wilton	30	4883
Fairlawn Nurseries	Darien	8	7177
Fairway Gardens	Woodmont	1	7120
Farmington Valley Nursery	Avon	5	7123
Ferchau, Hugo	Milford	2	7100
Ferruci, Joseph	Bridgeport	1	7209
Flower City Rose Company	Manchester	23	7113
Follett Nursery	Westport	10	6057
Forbes Street Greenhouse	East Hartford	1	7207
Fountain Nurseries	Farmington	10	6066
Foxon Park Nursery	East Haven	1	4886
Frank & MacArthur	Ansonia	1	7105
Fraser's Nurseries & Dahlia Gardens	Willimantic	3	5975
Frede, Wm. Frederick	Danbury	1	5939
Galligan, Clarence W.	New Haven	1	7145
Garden Exchange, The	Bridgeport	1	7183
Garden of Romance, The	Old Saybrook	3	7195
Gardner's Nurseries	Rocky Hill	300	5914
Geduldig's Florist & Nurseryman	Norwich	7	7124
George's Hill Nursery	Southbury	1	7130
German, Peter B.	Fairfield	1	7157
Giana, John F.	Kensington	1	4848
Giant Valley Nursery	Mount Carmel	1	6098
Glastonbury Gardens	Glastonbury	4	4882
Gledhill Landscape & Tree Service	West Hartford	1	7205
Glenbrook Greenhouses	Glenbrook	1	4854
Glen Echo Farm	Bridgeport	1	4830

Name	Address	Acreage	Certificate Number
Glen Terrace Nurseries	Hamden	70	4858
Glenwood Nurseries	Clinton	2	6048
Godfrey, George R., Stratfield Nursery	Bridgeport	50	5919
Godfrey Tree Expert Co. & Garden Shop	Fairfield	1	5996
Golden Hill Nurseries	Shelton	2	5948
Goodwin Nurseries	Bloomfield	13	5937
Goshen Nurseries	Goshen	6	7203
Gosnell, Evelyn	Westport	1	6067
Great Pond Nursery	Hartford	1	4857
Green Acre Farms, Inc.	Waterford	1	6008
Grillo, N.	Milldale	1	4856
Gunn, Mrs. Charles	Kent	1	7129
Haas, Florist	Milford	1	4846
Hamden Nursery	Hamden	1	7138
Hansen's Florist & Nursery	Fairfield	5	7167
Hansen's Garden	Newington	2	7122
Hearn, Thomas H.	Washington	3	7146
Heath & Company	Manchester	15	7114
Henninger, Christ.	New Britain	1	6063
Hettinger, Joseph O.	Manchester	1	7117
Hildebrand's Nursery	Norwich	1	4893
Hilding Brothers	Amston	1	6094
Hillcrest Gardens	Woodbridge	4	5962
Hilliard, H. J.	Sound View	1	5999
Hilltop Nurseries	Orange	1	4845
Hinckley Hill Nurseries	Stonington	1	6074
Hiti Nurseries	Pomfret Center	11	4874
Hoffmann's Nursery	Hartford	2	7107
Hofmann, William T.	Cromwell	3	6056
Holcomb's Evergreen Nursery	Winsted	6	4865
Holdridge & Sons, S. E.	Norwich	3	6023
Hope Street Nursery	Springdale	1	7188
Horan, J. F.	Hartford	1	7104
Horan, Kieran W.	West Hartford	1	7210
Horowitz, Ben	East Hampton	1	6087
Hosking, James S.	Watertown	2	5947
Hotchkiss, H. L.	North Haven	1	7184
Hotchkiss, Sr., Wallace M.	Norfolk	1	6071
Houston's Nurseries	Mansfield Depot	5	6040
Hoyt, Charles E.	Bethel	40	6011
Hoyt's Sons Co., Inc., Stephen	New Canaan	500	4864
Hurlburt Nursery	Hamden	1	6082
Hutt, Robert F.	Glastonbury	3	6090
Hyatt, Thaddeus	Stamford	3	7213
Isselee's Sons, Inc., Charles	Darien	5	5911
Jennings, Sereno G.	Southport	2	6001
Johnson, Lincoln	Stamford	15	5929
Johnson, Tom	Stratford	1	6077
Joyosa Gardens	Cornwall Bridge	1	4863
Kateley, Milton M.	East River	1	4862
Kelley & Son, James J.	New Canaan	6	5909
Kellner, Arthur H.	Norwalk	1	6032
Kennedy, Wellington	Greenwich	20	7154
Keso Nursery	Clinton	1	7194
Key Rock Gardens	Newtown	2	6061
Knobling, Edmund	Danbury	3	6017

Name	Address	Acreage	Certificate Number
LaBell, Harold (2)	East Haven	5	7110
Lanedale Farm Nurseries	New Canaan	10	6007
Langstroth Nurseries	Danbury	6	5968
Laviola & Sons	New Haven	2	7180
Leghorn's Evergreen Nursery	Cromwell	40	6095
Lemmon, Robert S.	New Canaan	1	7173
Lewis & Valentine Landscape Corp.	Darien	9	5991
Lewis Gardening Service	Kensington	3	4861
Lipari, V.	Bridgeport	1	7201
Lovely Garden	Unionville	1	7127
Lowescroft Gardens	Manchester	1	7102
Luce, Mrs. Charles L.	Newington	1	7175
Luckey, Ada Mae	Greens Farms	1	6036
Luckner, Jr., William	Stepney	1	6038
Lynch, Mrs. John H.	Ridgefield	3	5984
Marigold Farm	New Canaan	20	5983
Marlboro Nurseries	East Hampton	2	6070
Mather Homestead	Darien	2	4859
McCarthy, John P.	Danbury	2	5971
McConville's Greenhouses & Nurseries	Manchester	4	5908
Meier, A. R.	West Hartford	1	5956
Melville Nurseries	Bridgeport	1	6002
Merwin Lane Nursery	East Norwalk	3	5931
Meyer Nursery, Ludwig	Bridgeport	5	5928
Middeleer	Darien	10	6076
Midway Nurseries (2)	New Haven	10	7168
Milford Nursery	Milford	2	7136
Millane Nurseries & Tree Experts, Inc.	Cromwell	100	4844
Mill River Nursery	Fairfield	8	4898
Millstone Garden	Terryville	1	6099
Montgomery Ward & Company	Manchester	5	7172
Moore Hill Nurseries	New London	2	6029
Moraio Bros.	Old Greenwich	5	5986
Morgan, Everett E.	Stonington	1	5924
Morgan & Sons, Wm. F.	North Stonington	2	6072
Mountain Grove Cemetery Association, The	Bridgeport	1	4894
Mount Carmel Nursery	Mount Carmel	1	7141
Mount Phillip Nursery	Weatogue	2	7206
Munro, Edward A.	New Haven	1	5903
New England Water Lily Gardens	Manchester	1	4860
New Era Seed Company	Clinton	2	5901
New Haven Park Commission	New Haven	6	4847
New Haven Park Department, Bureau of Trees	New Haven	7	6045
Newington Gardens & Nurseries	Hartford	1	7197
New London Cemetery Association	New London	1	7179
New London County Nurseries	New London	10	5935
Newton's Nursery	West Granby	1	7150
New York, New Haven & Hartford Railroad	Stamford	3	4843
Niantic Bouquet Shop	Niantic	1	7163
North-Eastern Forestry Co., The	Cheshire	96	4895
North Greenwich Nursery	Greenwich	1	5995
North Street Gardens	Milford	1	7160
Northville Gardens	New Milford	1	6092
Norwalk Perennial Garden	Norwalk	4	4891
Nyveldt's Nursery	New London	3	5945
Oakland Nurseries	Manchester	20	7115
Oldfield Nursery	Stratford	1	7211

Name	Address	Acreage	Certificate Number
Outpost Nurseries, Inc.	Ridgefield	700	4888
Ouwerkerk, Dirk K.	Yalesville	10	5941
Over-the-Garden-Wall	West Hartford	3	6006
Oxoboxo Nursery	Montville	2	6055
Palmieri Nursery & Florist	New Haven	1	4839
Parker, Mrs. Elizabeth	Bridgeport	4	5982
Partrick Nursery	Sandy Hook	1	7101
Pendleton's Flower Gardens	Norwich	1	5989
Pestretto, Frank	West Hartford	1	7176
Pestretto, Salvatore	Hartford	1	7170
Peterson's Flower Shop	West Hartford	1	7174
Pierson, Inc., A. N.	Cromwell	300	5951
Pinchbeck Brothers, Inc.	Ridgefield	10	6088
Pine Hirst Gardens	Guilford	1	6043
Pine Plains Greenhouses	Norwich	2	7193
Platt, Kenneth M. & Norman E.	Milford	1	5993
Pleasure Gardens	Guilford	1	4866
Polen, Romuald	Southport	2	6026
Polish Orphanage Farm	New Britain	1	6062
Pomeroy Nurseries	New Milford	1	6020
Prospect Nurseries, Inc.	Cromwell	30	5976
Q Garden Farms Nursery	Milford	1	4875
Rabinak Flower Farm	Deep River	4	5940
Race Brook Gardens	Orange	1	4838
Reliable Nursery, The	East Hartford	2	6021
Rengerman's Garden	Granby	2	5920
Reveley Landscaping Service, The	Clinton	1	5965
Reynolds' Farms	South Norwalk	2	4870
Richmond, Gordon L.	New Milford	10	4876
Ridgewood Nurseries	Milford	1	5907
Riese, F. K.	Watertown	1	7134
Riverside Farm	Milford	1	6012
Robinson Estate, Seymour N.	West Hartford	2	6093
Rockacres Nursery	Stamford	2	5990
Rockfall Nursery Company, The	Rockfall	10	5980
Rose Hill Nursery	Gildersleeve	3	7118
Russell Street Perennial Garden	South Manchester	1	5952
Sage Brothers	Woodbury	1	7137
Sakson's Nursery	Greenwich	1	6060
Sandelli Greenhouses	New Britain	1	5921
Sasco Hill Nursery	Fairfield	1	5988
Savanella Brothers Nursery	Torrington	2	7169
Scarano Nursery, Alphonse	Groton	1	4871
Schleichert Nursery	Bridgeport	4	5966
Schmidt, Walter A.	East Glastonbury	1	7200
Schneider, Adolf	Milford	1	6078
Schuller, John	Higganum	4	6097
Schulze, Edward E.	Bethel	1	7165
Scott's Nurseries	Bloomfield	10	6064
Scotty's Landscape Service	Woodbury	1	6004
Sears, Roebuck & Company	Manchester	10	7116
Seltsam's Pequonnock Gardens	Bridgeport	1	4873
Seymour Garden, Prudence	New Milford	1	4853
Sharon Valley Nursery	Sharon	1	5932
Silver City Nursery	Meriden	6	7131
Silver Lane Nursery	East Hartford	1	7191
Simonsen, H. C.	Plainville	2	6085
Sipocz Arrowhead Farm	Fairfield	1	4884

Name	Address	Acreage	Certificate Number
Smith, Edward A.	Mystic	1	4833
Soltes Nursery, M. J.	Shelton	2	4897
Southbury Nursery, The	Southbury	4	6028
Southington Nursery	Southington	15	6016
Southport Nursery	Southport	35	5906
South Wilton Nurseries	Wilton	9	4877
Stafford Conservatories	Stafford Springs	1	5904
Standish, Norman S.	Hanover	1	6091
Stannard, Julia	Wilton	1	7149
State Street Nursery	Hamden	5	6049
Steck, Charles A.	Newtown	20	5913
Steck Nursery	Bethel	4	6046
Steele's Nurseries, Charles	Greenwich	3	5933
Stocking, Milton C.	Avon	1	6053
Sunny Valley Nursery	New Milford	15	4878
Sunridge Nurseries	Greenwich	55	7156
Sun Rise Nursery	North Haven	1	4835
Swendson, Hans	Cheshire	1	5902
Sylvan Greenhouse & Nursery	Bridgeport	1	6068
Taylor, Walter G.	Wallingford	1	6050
Thomson Company, W: W.	West Hartford	4	5977
Tobin, Daniel J.	Ridgefield	2	4834
Tollgate Nursery	Avon	1	5942
Torizzo, P. A.	West Hartford	5	5957
Tow Path Gardens, Inc.	Hartford	5	5918
Tracy, B. Hammond	West Hartford	1	7214
Triangle Nursery	Yalesville	2	5992
Twin Pines Gardens	New Milford		6035
University of Connecticut	Storrs	1	5981
Valentine, William	Pomfret Center	1	6033
Valley View Nursery	Southington	1	6052
van der Bom, Mrs. F.	Bethel	5	7121
Vanderbrook & Son, C. L.	Manchester	60	4881
Van Horn & Harrington	Suffield	1	6084
Van Wilgen, Wm.	Branford	1	6025
Van Wilgen Nurseries	Branford	22	5912
Vasileff Nurseries	Greenwich	6	6079
Verkade's Nurseries	New London	60	5974
Vernick's Nurseries & Landscape Service	Bridgeport	2	5994
Wagner, William H.	Woodbury	1	5946
Wallace Nursery	Wallingford	2	6015
Wallingford Nurseries	Wallingford	75	5950
Ward & Son, J. F.	Windsor	1	5927
Watertown Nurseries	Watertown	1	7158
Wayside Garden	Canton	1	5936
Wayside Nursery	Naugatuck	2	5979
Weinberger, William	Ridgefield	1	5910
West Cornwall Nurseries	West Cornwall	1	5943
Westerly Nurseries	Pawcatuck	2	6058
West Mystic Gardens	West Mystic	1	5985
Westover Trading Corp.	Stamford	1	5954
Westville Nurseries	Westville	2	4832
Wethersfield Nursery	Wethersfield	3	6083
Wheeler, Charles B.	Stonington	1	6086
Whipple, Earle G.	Danielson	1	7132
Whittemore Company, J. H.	Naugatuck	3	5970
Wildflower Nurserv, The	Brookfield	1	7108
Wild's Nursery, Henry	Norwalk	23	4890

Name	Address	Acreage	Certificate Number
Willow Gardens	Darien	1	6003
Willson, Stewart H.	Thompsonville	1	7212
Wilridge Nurseries	Ridgefield	5	7128
Wilson, M. L.	Litchfield	5	6013
Wilson Nurseries, C. E.	Manchester	75	6041
Wilson Landscape Company, The	Hartford	1	5958
Woodbridge Nurseries	New Haven	15	4896
Woodcrythe Nursery (W. S. Sloan)	New Canaan	1	7162
Woodmont Nurseries	Woodmont	60	4879
Wyllie, David	North Haven	1	7147
Yale University School of Forestry Nursery	New Haven	1	7161
Yale University Landscape Dept.	New Haven	10	4851
Young's Nurseries	Wilton	4	5963
Zack Company, H. J.	Deep River	10	7144
Total	**376 nurseries**	**4,859 acres**	

The cost of inspecting these nurseries, including certain additional visits to make sure that the pests had been properly eradicated, was approximately $1,835.65, exclusive of traveling expenses.

Other Kinds of Certificates Issued

During 1940, 208 duplicate certificates were issued to Connecticut nurseries to be filed in other states. One hundred and two dealers' permits were issued to dealers, who do not grow the nursery stock which they sell. All this stock is purchased from certified nurseries for resale. Shippers' permits to the number of 264 were issued to out-of-state nurserymen who wished to ship stock into Connecticut. Also, 212 parcels of nursery stock and other plant material were inspected and certified for shipment to accommodate individuals. There were also issued 208 miscellaneous certificates and special permits, 173 blister rust control area permits, 1,051 corn borer certificates, and 3,665 certificates for packages of shelled corn and other seeds, most of which were consigned to foreign countries.

Inspection of Imported Nursery Stock

Foreign nursery stock enters the United States at designated ports of entry under permits issued by the Federal Bureau of Entomology and Plant Quarantine and is released for transit to destination points, where it is examined by State inspectors. Importation permits are usually granted for rose stocks only. These stocks are used almost entirely by florists for grafting purposes. The number of shipments of imported rose stocks entering Connecticut from foreign countries was less during 1939-1940 than in the previous year. Rose stocks are now being grown in larger amounts in the United States and less foreign material is coming into the State. Six shipments containing 29 cases and 239,400 rose plants, all of which were for propagation purposes, were imported. All of them were *Rosa* *manetti.* These plants were all imported by three commercial rose growers who received 164,400, 40,000, and 35,000, respectively. They came from the following sources:

Country	No. shipments	No. plants
Holland	5	199,400
England	1	40,000

The time required to inspect this rose stock was equivalent to four days' work for one man and this, together with travel (320 miles) and other necessary expenses, amounted to a cost of approximately $56. Reports of the results of inspection of the six shipments were sent to the Federal Bureau of Entomology and Plant Quarantine.

Of the six shipments inspected, only one was found infested with larvae of a sawfly, *Emphytus cinctus* Linn., which enters the pith of the cut stems seeking a place to pupate. No crown gall, a bacterial disease, was found.

In addition to the rose stocks mentioned above, the following miscellaneous plants and seeds entered Connecticut after Federal inspection at ports of entry. None of these was inspected in Connecticut. This material is allowed entry into the United States in small lots under a special permit issued by the Bureau of Entomology and Plant Quarantine, and is sent to Washington, D.C., for inspection.

7,796	orchid plants	24	rose plants
2,794	pounds of seeds	5	holly plants
46	dahlia tubers	15	English walnut trees
66	iris plants	2	spruce trees
135	perennials	2	lilac bushes
9,450	gladiolus		

JAPANESE BEETLE QUARANTINE ACTIVITIES, 1940

M. P. Zappe

Since the establishment of the Japanese beetle quarantine in Connecticut, the Department of Entomology of the Connecticut Agricultural Experiment Station has cooperated with the Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture in administering this quarantine. The work consists of seasonal scouting of certain nursery and greenhouse properties and their sources of sand, soil and manure for classification purposes; the inspection and certification of all articles included in the quarantine regulations; and other tasks necessary to the operation of the quarantine.

The State is divided into two sections, using the gypsy moth quarantine line as a boundary. That section of the State within the gypsy moth quarantined area, which includes Hartford, Middlesex, New London, Tolland and some towns in eastern Litchfield and New Haven counties, is under the supervision of Mr. H. N. Bartley, in charge of the Federal Japanese beetle office at Waltham, Mass. His inspectors make the necessary inspections to comply with the

Japanese beetle and gypsy moth quarantines, and European corn borer inspections as required by certain states. In the rest of the State the inspections are made from the New Haven office at the Experiment Station. During the rush of the shipping season in the spring, when Mr. Bartley's inspectors are very busy, the towns of Branford and North Haven are often placed under the supervision of the New Haven office.

Scouting

Scouting for the Japanese beetle has been conducted yearly, and the procedure followed during the summer of 1940 to determine whether or not adult beetles were present on classified properties was similar to that of preceding years. Three crews were used to carry on this work, two of which were under the supervision of the Waltham office, each consisting of one foreman and two scouts. They began scouting on July 9 and finished on August 31. The third crew, consisting of one foreman and one scout, under the supervision of the New Haven office, began on July 15 and finished on September 6. Each crew followed a prepared itinerary as in previous seasons. They scouted 33 nursery, greenhouse or other similar establishments and their subdivisions, a total of 66 units, three to five times. The minimum distance examined around each establishment was 500 feet. A total of 887 adult beetles was found on or within 500 feet on 31 of the units scouted. The crews also scouted the premises of 21 dealers in sand, soil and manure and found one beetle on one of these establishments. The finding of infestations on scouted premises resulted in 10 changes in classification and 22 establishments dropping their classified status under the quarantine regulations.

Beetles were found in Orange, Middlefield and Woodbridge for the first time. There are 83 towns now known to be infested and probably many others that have not come to our attention.

Inspection and Certification

The district inspectors are responsible for the inspection and certification of quarantined materials on account of the gypsy moth and Japanese beetle quarantines. The following is a list of these men and the towns in which they make inspections:

R. L. Emrick, Box 63, Sta. A, Manchester. Telephone Manchester 4482.

Avon	Enfield	Stafford
Barkhamsted	Farmington	Suffield
Bloomfield	Granby	Tolland
Bolton	Hartford	Torrington
Burlington	Hartland	Union
Canton	Harwinton	Vernon
Colebrook	Manchester	West Hartford
Coventry	Mansfield	Willington
East Granby	New Hartford	Winchester
East Hartford	Simsbury	Windsor
East Windsor	Somers	Windsor Locks
Ellington	South Windsor	

J. F. McDevitt, Box 45, Middletown. Telephone Middletown 1613.

Andover
Berlin
Branford
Bristol
Chester
Clinton
Colchester
Columbia
Cromwell
Durham
East Haddam
East Hampton
Essex
Glastonbury
Guilford
Haddam
Hebron
Killingworth
Lebanon
Madison
Marlborough
Meriden
Middlefield
Middletown
New Britain
Newington
North Branford
North Haven
Old Saybrook
Plainville
Plymouth
Portland
Rocky Hill
Saybrook
Southington
Thomaston
Waterbury
Westbrook
Wethersfield
Wolcott

Daniel Harrington, Box 63, Westerly, R. I. Telephone Westerly 2604.

Ashford
Bozrah
Brooklyn
Canterbury
Chaplin
Eastford
East Lyme
Franklin
Griswold
Groton
Hampton
Killingly
Ledyard
Lisbon
Lyme
Montville
New London
North Stonington
Norwich
Old Lyme
Plainfield
Pomfret
Preston
Putnam
Salem
Scotland
Sprague
Sterling
Stonington
Thompson
Voluntown
Waterford
Windham
Woodstock

L. A. Devaux and A. S. Beecher, Box 1106, New Haven. Telephone New Haven 5-6191. All towns not listed above.

The total number of plants inspected and certified for shipment to other states and foreign countries was 7,308,128.

The number and kinds of certificates issued are shown in the following table:

TABLE 2. NUMBER OF CERTIFICATES ISSUED, 1940

Kind	Farm Products	Cut Flowers	Nursery and Ornamental Stock	Sand Soil	Manure	Total
"A"	0	28	38,188	2	0	38,218
"B"	0	0	7,839	0	1	7,840
Total	0	28	46,027	2	1	46,058

As in past seasons, the district inspectors were able to make the necessary farm products quarantine inspections in addition to their regular duties. These were few in number and consisted of 28 boxes of cut flowers. No inspections were made of farm products material because the Town of Greenwich was the only town in the State where such inspections were required and no shipments were made therefrom.

INSPECTION OF APIARIES, 1940

M. P. ZAPPE

Mr. H. W. Coley, who had been the bee inspector in Fairfield, New Haven, Middlesex and New London counties, retired from service in 1940 and Mr. Roy Stadel of Southington was appointed on April 15, 1940, to inspect bees in the above mentioned parts of the State. Mr. H. W. Kelsey of Bristol inspected bees in the four northern counties.

A total of 1,719 apiaries containing 8,552 colonies were inspected in 1940. These averaged 5.0 colonies per apiary, as against 5.5 in 1939. There were 366 colonies in 161 apiaries infected with American foul brood, a considerable increase over the number found in 1939. Most of this increase occurred in the four southern counties. Several of the apiaries were inspected twice, as in order to burn the diseased colonies it was necessary for the inspectors to make a second visit to these apiaries. Only one colony was found infected with sacbrood.

TABLE 3. THIRTY-ONE YEAR RECORD OF APIARY INSPECTION

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
1938	1,609	10,705	6.7	1.18	.177
1939	1,627	8,936	5.5	1.12	.204
1940	1,719	8,552	5.0	1.33	.268

Table 3 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 1940 apiaries were inspected in 143 towns. No inspections were made in the following 26 towns owing to shortage of time and money: Bridgeport, Canaan, Chester, Columbia, Darien, Franklin, Griswold, Groton, Killingworth, Lebanon, Ledyard, Lyme, Madison, Manchester, New Haven, North Stonington, Norwalk, Old Lyme, Saybrook, Sprague, Stafford, Union, Voluntown, Westbrook, West Haven, and Weston.

American foul brood was discovered in the following 76 towns:

Fairfield County: Bethel, Brookfield, Danbury, Greenwich, Monroe, New Canaan, New Fairfield, Newtown, Redding, Ridgefield, Shelton, Sherman, Stamford, Wilton.

New Haven County: Beacon Falls, Branford, Cheshire, Derby, East Haven, Guilford, Hamden, Meriden, Middlebury, Milford, Naugatuck, North Branford, North Haven, Orange, Oxford, Prospect, Seymour, Southbury, Wallingford, Woodbridge, Wolcott.

Middlesex County: Durham, East Hampton, Middlefield, Middletown.

New London County: East Lyme, Colchester, Lisbon, Montville, Norwich, Preston, Stonington, Waterford.

Litchfield County: Bethlehem, Bridgewater, Harwinton, Litchfield, Morris, Plymouth, Salisbury, Torrington, Washington, Watertown.

Hartford County: Berlin, Bloomfield, Bristol, East Hartford, East Windsor, Farmington, New Britain, Simsbury, Southington, West Hartford, Windsor.

Tolland County: Coventry, Ellington, Somers, Stafford, Tolland, Vernon.

Windham County: Ashford, Windham.

Statistics of Inspection

The statistics of apiary inspection are given below.

Table 4. Inspection of Apiaries, 1940

County	Number of towns	Apiaries Inspected	Apiaries Diseased (Am. f. b.)	Colonies Inspected	Colonies Diseased (Am. f. b.)
Fairfield	18	199	45	1,121	106
New Haven	25	238	46	1,385	130
Middlesex	10	98	7	682	8
New London	11	95	16	643	44
Litchfield	25	296	16	1,321	24
Hartford	28	472	20	2,315	34
Tolland	11	169	7	467	15
Windham	15	152	4	618	5
	143	1,719	161	8,552	366

SUMMARY OF INSPECTION

	Apiaries	Colonies
Inspected, 1940	1,719	8,552
Infected with American foul brood	161	366
Percentage infected	9.4	4.3
Colonies treated		14
Colonies destroyed		352
Average number of colonies per apiary		5.0
Average cost of inspection	$1.33	$ .268
Total cost of inspection, 1940	$2,291.95	

Financial Statement

January 1, 1940 — December 31, 1940

Disbursements

January 1 to June 30, 1940:		
Salaries	$582.00	
Travel (outlying investigations)	458.60	$1,040.60
July 1 to December 31, 1940:		
Salaries	$702.00	
Travel (outlying investigations)	549.35	1,251.35
Total disbursements for 1940		$2,291.95

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 1940, 1,719 apiaries containing 8,552 colonies were inspected. However, only 904 apiaries and 6,117 colonies were registered. After checking the registrations and inspections, and deducting duplications, the following figures were obtained showing that at least this number of apiaries and colonies were kept in Connecticut in 1940.

	Apiaries	Colonies
Inspected	1,719	8,552
Registered but not inspected	60	428
	1,779	8,980

REPORT ON THE GYPSY MOTH, 1939-1940

R. B. FRIEND, J. T. ASHWORTH AND O. B. COOKE

Introduction

The gypsy moth is the most serious insect pest of hardwood trees in the State. Unfortunately it attacks some of our most useful and abundant species. Although all trees attacked during an outbreak do not die, a severe retardation of growth follows defoliation, which means a decrease in the production of wood. Moreover, defoliated trees markedly lessen the attractiveness of the recreational areas in the State. This insect is now firmly established in Connecticut and occurs in greater or less abundance over much of its area. The prospect of eliminating it from the entire State is too remote for practical consideration, so our main concern is to prevent serious injury to our forests and shade trees. In order to accomplish this it is necessary to prevent the development of outbreaks, during which the trees may be stripped of foliage for two or more successive years. The prevention of outbreaks is based on a knowledge of the insect and of the effect of environment factors on its activities and abundance, a thorough understanding of the effect of the insect on trees under various growing conditions, and on efficient control methods.

Since control work started with the discovery of the gypsy moth in the State in 1906, only three serious outbreaks have occurred. The largest of these, involving about 1,500 acres in the towns of Granby, Canton, and Simsbury in 1938 and 1939, has been described in the two previous reports of this office. Although the insect has increased in abundance in many towns during the last few years, an attempt is being made to handle the situation without increasing the personnel involved. Work now being carried out by this department, by investigators in other states, and by the Federal Bureau of Entomology and Plant Quarantine should be of distinct aid in increasing the efficiency of operations.

Gypsy moth control work has been carried on during the past year (1939-1940) in much the same manner as in previous years. During the fall, winter and early spring, trees are inspected for egg-masses. These egg-masses are destroyed when found. During the late spring and early summer, the larger infestations are sprayed to reduce or possibly eradicate them. During the summer months, areas infested with the gypsy moth are patrolled to detect gypsy moth caterpillars. With the cooperation of the United States Bureau of Entomology and Plant Quarantine, and the C.C.C., control work in one form or another was performed in 59 towns in all sections of the State during the past year.

To the following persons the writers here express thanks for their hearty cooperation: Mr. A. F. Burgess, who has general supervision of gypsy moth and brown tail moth control for the Federal 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 C.C.C. camps in the central section of the State; and to Mr. A. F. Hawes, State Forester, who has general supervision of the C.C.C. camps.

New Equipment

Just prior to the spraying season, one length of suction hose was purchased to replace a length that had become worn out, and considerable repair work, which was badly needed, was done on the two sprayer pumps, putting them in good condition. There was no replacement of department vehicles during the past year. The usual number of small wrenches and other tools that had become worn out or broken were replaced.

Control Operations

Following is a brief report of gypsy moth control operations carried on by the different agencies during the past year.

Work Performed by State Men

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

Windham County: Scouting work was performed in the towns of Brooklyn, Killingly and Plainfield. Gypsy moth infestations were found in all towns visited. No other type of control work was performed in this County.

New London County: The towns of Colchester, East Lyme, Groton, Lisbon, Montville, New London, North Stonington, Old Lyme and Stonington were visited, gypsy moth egg-masses or larvae (caterpillars) being found in all of them. There was no spraying work carried on in the County.

Tolland County: Two towns, Stafford and Union, were inspected and gypsy moth infestations were found in both. No spraying or patrolling (larvae) work was carried on in this County.

Hartford County: Gypsy moth control work in the form of scouting or patrolling for larvae was performed in the towns of Bloomfield, East Granby, Enfield, Granby, Hartford, Manchester, Simsbury, South Windsor and West Hartford, egg-masses being found and larvae taken in all towns visited with the exception of Hartford. Only a small section in the northern part of Hartford was scouted, and this mainly because it was adjacent to infested territory in the town of Bloomfield. Hence this does not indicate that Hartford is free from gypsy moth infestation.

Litchfield County: Two towns were scouted during the past season, gypsy moth infestations being found in both. There was no spray work performed in the County by state crews this season.

There was no gypsy moth control work carried on in Middlesex, New Haven and Fairfield counties, by state crews in the past year.

During the year, state men scouted 304 miles of roadside, 1,493 acres of woodland and open country, and destroyed 26,320 egg-masses and 19,722 larvae and pupae.

During the month of September, 1939, some of the crews were started on a type-mapping project, and, coincidentally, a survey to determine the density of the gypsy moth population in the towns that were being type-mapped. The type-mapping consisted of a survey of the wooded and open areas of a town to determine the percentage of favored and unfavored food plants of gypsy moth larvae. This information is placed on outline maps of the towns, using different colors to indicate the different percentages of favored food plants in each block. These maps, together with the data received from the survey made to determine the density of gypsy moth population in the same town, are filed, and it is expected that frequent study of this information will enable us to anticipate where the greatest increase in the gypsy moth is likely to occur, and, by periodic inspection of the most dangerous areas, to prevent the gypsy moth infestations in these areas from reaching the stage where large areas of woodland are defoliated. It will also be the means of enabling a small force, such as we have at the present time, to cover, in one season, a much larger portion of the State than has been done previously. This work was carried on in the towns of Brooklyn, Groton, Killingly, North Stonington, Plainfield, Pomfret, Stonington, Thompson, and Woodstock, during the past year.

During the spraying season, state men were engaged in control operations at a large infestation at "West Peak", Meriden, and a large infested area, located in the towns of Granby, Simsbury and Canton, previously reported in 1938-1939. Again this year, it was necessary for the State to obtain the loan of spraying equipment from the Federal Bureau of Entomology and Plant Quarantine and to secure the use of C.C.C. men to assist in the spraying operations. Due to the size of the area involved at the Granby-Simsbury-Canton infestation, and the time available to complete the work, four power spraying machines, working two shifts a day, were used. This operation required the use of approximately 120 C.C.C. men and all available state men each day. Smaller infested areas in the towns of Barkhamsted, Berlin, Burlington, and Hartland were also sprayed. Altogether 1,574 acres of woodland were sprayed and 43,786 pounds of arsenate of lead used.

For the first time in Connecticut, an autogiro was used to dust two plots, 461-acre total, in the Granby-Simsbury-Canton area during the past spraying season. This autogiro, the property of the U. S. D. A., Bureau of Entomology and Plant Quarantine, is equipped with special apparatus which enables it to fly over a marked area and expel a mixture of arsenate of lead and fish oil on the foliage much more quickly and with much less effort than can be accomplished with a ground spraying machine. A more complete report of the dusting by autogiro will be published when all the data have been compiled and analyzed.

Work Performed by C.C.C. Men

During the past season, details of men from the C.C.C. camps located in the central part of the State performed gypsy moth control work in the following towns: Durham and Middletown in Middlesex County; Berlin, Burlington, Canton, Granby, Hartland, Simsbury, and Southington in Hartford County; Branford, Guilford and Meriden in New Haven County; and Barkhamsted, New Hartford and Winchester in Litchfield County. This control work consisted of scouting, thinning, and spraying. During the course of the work year they creosoted 862,299 egg-masses, destroyed 10,426 larvae and pupae, scouted 129 miles of roadside and 51,494 acres of woodland.

Work Performed by W.P.A.

A gypsy moth control project financed by funds furnished by the Works Progress Administration and supervised by the U. S. D. A., Bureau of Entomology and Plant Quarantine, was carried on in the western part of the State in Hartford, New Haven and Litchfield counties. With the exception of a small supervisory force, all the labor employed on this project was received from the relief rolls of the towns in the vicinity of which control work was carried on. Control work in the form of scouting, thinning, banding and spraying was performed in 23 towns in these three counties, during the course of which 30,236 egg-masses were found and destroyed, 119,513 larvae and pupae were destroyed, and 346 miles of roadside and 85,799 acres of open and wooded country scouted. During the spraying season, 21 infestations were sprayed, 71,537 pounds of arsenate of lead being used during the operations.

Scouting for Brown-Tail Moth

There was no brown-tail moth scouting project carried on in this State during the 1939-40 season.

TABLE 5. STATISTICS OF INFESTATIONS, 1939-1940.

Towns	Infestations found	Egg-masses creosoted	Number colonies sprayed	Lbs. lead used	Larvae, pupae crushed	Bands applied	Miles scouted	Acres scouted	Acres cleaned
Windham County									
Brooklyn[1]	2	50	0	0	0	0	0	35	0
Killingly[1]	2	28	0	0	0	0	0	24	0
Plainfield[1]	2	54	0	0	0	0	0	57	0
	6	132	0	0	0	0	0	116	0
New London County									
Colchester[1]	1*	1	0	0	37	0	0	0	0
East Lyme[1]	1*	2	0	0	0	0	6	95	0
Groton[1]	2*	273	0	0	0	0	0	0	0
Lisbon[1]	1	13	0	0	0	0	48	0	0
Montville[1]	1*	1	0	0	0	0	0	0	0
New London[1]	1*	2	0	0	1,429	0	0	0	0
North Stonington[1]	1*	122	0	0	0	0	0	0	0
Old Lyme[1]	1	28	0	0	0	0	69	17	0
Stonington[1]	5*	891	0	0	0	0	0	0	0
	14	1,333	0	0	1,466	0	123	112	0
Tolland County									
Stafford[1]	1	3,114	0	0	1,357	0	17	0	0
Union[1]	1	8,062	0	0	0	0	0	12	0
	2	11,176	0	0	1,357	0	17	12	0
Middlesex County									
Durham[2]	2	3	0	0	1	4,985	0	141	1
Middletown[2]	6	443	0	0	0	0	6	2,247	11
	8	446	0	0	1	4,985	6	2 388	12

TABLE 5. STATISTICS OF INFESTATIONS, 1939-1940—Continued

Towns	Infestations found	Egg-masses creosoted	Number colonies sprayed	Lbs. lead used	Larvae, pupae crushed	Bands applied	Miles scouted	Acres scouted	Acres cleaned
Hartford County									
Berlin[2]	9	70	2	924	0	0	12	2,445	29
Bloomfield[1]	20	4,513	0	0	3,577	0	46	0	0
Burlington[2]	11	1,483	3	6,900	482	12,895	6	1,912	12
Canton[2]	23	10,021	1	1,478	0	0	29	11,199	0
East Granby[1]	26	7,265	0	0	0	0	44	46	0
Enfield[1]	3	203	0	0	1,236	0	11	0	0
Granby[5]	23	442,588	6	14,742	7,057	0	13	7,430	370
Hartford[1]	0	0	0	0	0	0	1	0	0
Hartland[2]	20	2,103	2	3,783	5,348	33,816	17	5,755	1
Manchester[1]	1	59	0	0	308	0	19	0	0
Simsbury[5]	4	394,202	2	4,328	2,784	0	2	954	144
Southington[2]	1	276	0	0	0	0	0	164	0
South Windsor[1]	1	250	0	0	1,343	0	7	0	0
West Hartford[4]	2	203	0	0	6,211	17,344	1	3	54
	144	863,236	16	32,155	28,346	64,055	208	29,908	610
New Haven County									
Ansonia[3]	0	0	0	0	0	0	13	1,559	0
Branford[2]	0	0	0	0	126	1,030	0	0	0
Guilford[2]	4	10	0	0	20	5,280	8	5,829	4
Meriden[2]	2	396	1	5,098	0	0	1	874	7
New Haven[3]	1	43	1	105	0	0	7	479	0
Southbury[3]	3	21,861	1	9,899	105,136	23,867	26	3,955	37
Woodbridge[3]	0	0	0	0	0	0	1	78	0
	10	22,310	3	15,102	105,282	30,177	56	12,774	48

TABLE 5. STATISTICS OF INFESTATIONS, 1939-1940—Continued

Towns	Infestations found	Egg-masses creosoted	Number colonies sprayed	Lbs. lead used	Larvae, pupae crushed	Bands applied	Miles scouted	Acres scouted	Acres cleaned
Litchfield County									
Barkhamsted[2]	42	10,593	6	6,535	4,306	53,978	34	11,415	0
Bethlehem[3]	0	0	0	0	0	0	0	6	0
Canaan[3]	22	1,154	1	352	2,125	15,521	4	2,731	5
Colebrook[1]	9	167	0	0	0	0	1	656	0
Cornwall[3]	13	3,747	2	28,838	2,973	73,172	10	4,192	0
Goshen[3]	12	145	0	0	640	0	6	1,845	0
Harwinton[1]	21	1,198	0	0	306	0	35	551	0
Kent[3]	2	2	0	0	0	1,303	6	1,502	0
Litchfield[3]	18	1,100	1	540	658	10,191	10	3,281	18
Morris[3]	5	26	0	0	116	4,780	0	191	0
New Hartford[2]	2*	104	0	0	0	0	2	1,130	0
New Milford[3]	0	0	0	0	0	0	110	29,365	0
Norfolk[3]	17	277	1	667	422	0	2	1,029	0
North Canaan[3]	8	310	1	330	266	0	8	2,239	0
Roxbury[3]	1	214	1	1,155	105	5,742	3	476	9
Salisbury[3]	9	246	4	9,600	187	6,681	6	3,165	0
Sharon[3]	2	8	1	60	0	3,020	1	680	0
Torrington[3]	2*	3	0	0	0	0	0	0	0
Warren[3]	9	363	0	0	776	9,794	1	670	0
Washington[3]	12	539	7	19,991	186	10,504	45	11,311	0
Winchester[6]	2	8	0	0	143	4,781	0	0	0
Woodbury[3]	4	18	0	0	0	0	90	17,043	3
	212	20,222	25	68,068	13,209	199,467	374	93,478	35

Summary of Statistics, 1939-1940.

County	Number of towns	Infestations found	Egg-masses creosoted	Number colonies sprayed	Lbs. lead used	Larvae, pupae crushed	Bands applied	Miles scouted	Acres scouted	Acres cleaned
Windham	3	6	132	0	0	0	0	0	116	0
New London	9	14	1,333	0	0	1,466	0	123	112	0
Tolland	2	2	11,176	0	0	1,357	0	17	12	0
Middlesex	2	8	446	0	0	1	4,985	6	2,388	12
Hartford	14	144	863,236	16	32,155	28,346	64,055	208	29,908	610
New Haven	7	10	22,310	3	15,102	105,282	30,177	56	12,774	48
Litchfield	22	212	20,222	25	68,068	13,209	199,467	374	93,478	35
	59	396	918,855	44	115,325	149,661	298,684	784	138,788	705

[*]Larval scout
[1]State
[2]C.C.C.
[3]U.S.D.A.
[4]U.S.D.A. and State
[5]C.C.C. and State
[6]C.C.C. and U.S.D.A.

DUTCH ELM DISEASE

M. P. Zappe

During the past year this Station has continued its cooperation with the United States Bureau of Entomology and Plant Quarantine in the control of the Dutch elm disease. The Bureau of Entomology does the actual control work and the Station carries on research and assists in obtaining permission of the land owners when control measures are necessary on their property. This Station also takes samples from certain new diseased trees found by the federal scouts, particularly in towns not previously known to be infected. Cultures are made from these samples and, if found to be positive, the trees are cut and burned. Dr. F. A. McCormick of the Department of Plant Pathology and Botany made a total of 123 cultures in 1940.

With the increasing scarcity of W.P.A. labor, the sanitation work has been somewhat curtailed. The ice storm in late winter of 1940 left many elm branches broken and hanging in the trees. All these were potential beetle breeding material and had to be removed. This added to the amount of work which had to be done to prevent an increase of bark beetles.

Three hundred seventy-eight diseased trees were found and destroyed during 1940. This makes a total of 1,686 trees which have been found infected with Dutch elm disease and removed since the work first started in Connecticut in 1933. Forty-one of those discovered in 1940 were in 17 towns in which the disease was detected for the first time. They are as follows:

Town	No. of diseased trees	Town	No. of diseased trees	Town	No. of diseased trees
Bethany	2	Morris	1	Preston	1
Bethel	2	Naugatuck	1	Torrington	1
Bethlehem	10	New Haven	1	Wallingford	3
Brookfield	1	New Milford	1	Waterbury	4
Harwinton	1	Orange	1	Watertown	2
Middlebury	2			Woodbridge	7

None of the new towns were far from the area generally infected with the exception of Preston, where one diseased tree was discovered. This town is 25 miles from the Old Lyme area where no diseased trees have been found since 1937. The Preston tree was about 50 miles from the nearest diseased tree found in 1940 in Guilford. The federal and state quarantines will probably be extended to include the towns where diseased trees were found this year.

MOSQUITO CONTROL IN CONNECTICUT, 1940[1]

R. C. Botsford, Field Agent
State Board of Mosquito Control

No serious mosquito nuisances were observed or reported in the state-maintained areas during 1940.

Routine duties of maintenance comprised the principal activity of the control crews this season. Your agent regularly inspected key points of control and potential breeding areas, and kept in constant touch with the crew foremen by telephone and personal contact in the field. Thus, jammed tide gates, damage to outlets, and complaints of mosquito nuisance, all of a minor nature, were promptly serviced. No set plan of maintenance of the 11,000 acres of salt marsh could be followed because the crews were moved from place to place as the emergency required.

Your agent attended the annual convention of the New Jersey Mosquito Extermination Association at Atlantic City, New Jersey, March 20-22, 1940, and read a short paper on mosquito control work in Connecticut. He also conducted a Connecticut field trip June 27, 1940, under the auspices of the Eastern Association of Mosquito Control Workers, showing some important W.P.A. projects associated with mosquito control.

Mosquito breeding developed in Fairfield in the Pine Creek Marsh, and oiling was necessary, the Town of Fairfield furnishing the oil. Breeding also developed near the Branford River and at East River, both of which areas were oiled. Other small breeding places were eliminated by spur ditching. Tide gate construction would improve areas in Branford, at Sybil Creek; in Fairfield, at Pine Creek; and in Clinton, at Indian River.

Federal aid mosquito control projects under the W.P.A. were reduced in number this year. Inability to secure the necessary sponsors' share of the cost and the reduction in numbers of relief labor were the principal reasons for this. On December 10, 1940, the Board was notified that the statewide projects sponsored by the Board would no longer be operated by the Ditching, Draining and Pest Control Project, also that no agency of the W.P.A. could render further engineering services, nor aid in obtaining releases. The individual projects are to be administered by the local area offices of the W.P.A. Three sub-projects of the statewide project remain in operation under local W.P.A. administration: Canoe Harbor, Madison; Great Harbor Dike, Guilford; and Pitkin Street, East Hartford. The Pitkin Street job is 80 percent completed and the remaining engineering work may be completed by the town engineers. The Canoe Harbor and Great Harbor jobs are more complex and will require periodical engineering services. The year 1941 will probably see the end of W.P.A. assistance in mosquito control work.

The following is a list of projects completed in 1940 or now in operation by W.P.A. transferred from the Pest Control Project to local area offices. All are town-sponsored excepting as noted.

Ansonia: Beaver Brook, slope paving and retaining walls. Colony Street; completed.

[1]The mosquito control work in Connecticut is now administered by a State Board of Mosquito Control of which the Director of this Station is chairman. Since the Board has no means of publication, the report of its Agent is given here.

East Hartford: Panzy's Pond and Pitkin Street, correcting drainage; 80 percent completed. Board sponsored by request.

Fairfield: Pine Creek Bridge; completed.
Rooster River, storm water improvements.

Groton: Benham Road and Warren Street, draining swamp.

Guilford: Great Harbor Dike, rebuilding dike damaged by hurricane. Sponsored by Board.

Madison: Canoe Harbor, marsh outlet and draining swamp. Sponsored by Board.

New Britain: Piper Brook, corrective work.
Bass Brook; completed.

New Haven: Lawncrest Brook, drainage completed.
West River and Wilmot Brook, temporarily suspended.
Little River, tide gate construction.
East Shore Meadows, improving outlet; 80 percent completed.

North Haven: Blakeslee Road, swamp drainage; completed.

Norwalk: Lockwood Lane, swamp drainage; 75 percent completed.

Plymouth: Pequabuck River, corrective work; 60 percent completed.

Stratford: Sniffen's Meadow, new outlet; 95 percent completed.
Bruce Brook, bridge and corrective work.

West Haven: Cove River, tide gate and sea wall.

Westport: Town Dump Swamp, drainage; completed.
Pussy Willow Swamp, ditching and corrective work.

RODENT CONTROL

Howard A. Merrill, Assistant District Agent

Fish and Wildlife Service, U. S. Department of the Interior

During the year research has been continued on the ecology and the control of pine mice (*Pitymys pinetorum*); the fluctuation or cyclic tendency of the population of meadow mice (*Microtus pennsylvanicus*); and the use of repellents as a protection for trees and shrubs against rabbits. Although a great deal is yet to be accomplished on all of these projects, progress is being made. Observations will be required for a period of several seasons before definite conclusions can be drawn.

Pine Mice

Research in the control of pine mice has entered its "stubborn" phase. Proper baits and poisons for control have been determined. The proper placing of these baits in the field under varying cultural practices has been fairly well established. However, the seasonal activity and behavior of pine mice, their rate of breeding and reinfestation, and the general population cycle or fluctuation, do not form as simple and well known pattern as in the case of meadow mice. Upon these factors depend the time of year and number of applications of the control method. Such information is gained principally through long term investigations on the ecology of pine mice. Research studies have been in progress in three widely separated sectors of the eastern fruit belt: in New York, Pennsylvania, and Delaware by D. A. Spencer; in the Shenandoah Valley, Virginia, by H. J. Spencer; and in Connecticut by H. A. Merrill.

In Connecticut during the early part of the winter (1939-1940) the pine mouse population was reasonably high, as determined by trapping in several orchards and by observations in others. During the latter part of February and March the population was reduced greatly. The exact cause of this reduction is not known; climatic conditions, however, were severe.

During the first two weeks in February an examination of a 10-acre block of mature apple trees was made at South Windsor, Connecticut. Numerous signs of pine mice were observed fairly evenly distributed over the entire block. One row selected at random, approximately in the center of the orchard, was trapped on February 13 and 14, most of the traps being set in underground burrows just below the sod. Pine mice were caught under 10 of the 17 trees in the row. A severe snow storm made it impossible to do further trapping at that time. An attempt was made to continue the trapping during March. However, a heavy layer of ice under the snow made this attempt unsuccessful. A few days of warm weather had melted some of the snow, allowing the water to run down into the burrows where it froze into solid cylinders.

Trapping was resumed again in April, as by this time the ground had thawed and conditions were more favorable for making underground sets. However, no mice were caught after trapping the entire block. No poisons had been used on the area. Similar conditions were found in other orchards throughout the State, and this low population in the spring made many of our projects difficult. The area established to study the rate of drift or reinfestation was made valueless because of the natural reduction in population in the surrounding area.

The effectiveness of concentration stations, in the form of tar paper squares and burlap squares, has been checked under various conditions. Under sandy soil conditions with light vegetative cover, pine mice were found to mound up the sand under the concentration station, making poisoning practically impossible. Under loam conditions with heavy vegetative cover, the concentration station did not give satisfactory results even after exposure for several months.

In conjunction with the collection of pine mouse stomachs, which are to be used in determining the general food habits and the months when the mice are feeding on apple tree roots, certain breeding data have been obtained, as indicated in Table 6.

TABLE 6. PINE MOUSE BREEDING

Month	Total Males Examined (adult)	Total Females Examined (adult)	Juveniles[1] Examined	Females Pregnant	Average Litter
April	21	23	6	6	2.00
May	21	20	12	7	2.14
June	9	12	3	4	2.50
July	11	12	1	4	1.75
August	11	10	6	5	2.20
Sept.	14	10	7	6	2.66
Oct.	14	11	5	2	2.00
Nov.	11	14	1	0	......
Dec.	16	13	3	0	......

[1]Pine mice weighing 20 grams or less are classified as juveniles.

Meadow Mice

The meadow mouse population was checked twice during the year, once during May and again in September. This census includes the work of 11 investigators reporting from 13 widely separated districts in the northeastern fruit belt. Field studies were made on approximately 150 different *Microtus* habitats and intensive trapping on 18 selected acre quadrats.

To standardize this *Microtus* population survey so that the readings of each investigator would be comparable, the following plan was followed: (1) In orchard areas, 50 tree bases in a block were examined for *Microtus* trails. (2) In meadow areas, six quadrats measuring 10 feet on the side and spaced at 20-foot intervals were read for the linear length of *Microtus* trails contained thereon. All surveys were required to be of areas representative of at least five acres of similar cover. (3) Supporting these trail sign surveys, each investigator trapped free an acre that he judged above the average in *Microtus* infestation in his district.

Extreme Variation in Microtus Numbers. The peak in the *Microtus* cycle terminated in late spring of 1939, through causes unknown. This was followed by a summer of severe drought in most of the Northeast that prevented any appreciable recovery during that breeding season. The winter of 1939-1940 was severe, the late spring replete with ice storms, and the population density was further depressed. With three successive blows it is no wonder that *Microtus* practically disappeared from many habitats. Thus, we may consider that the breeding foci in the spring of 1940 were not only low in numbers but scattered according to protection afforded by very localized habitat conditions. April, May and June of 1940 had above normal temperature and rainfall which resulted in excellent cover and food. Conditions then sharply reversed to below normal rainfall during July and August, checking plant growth. Several investigators made note of the fact that where mulching was practiced in an orchard the *Microtus* populations were noticeably higher. Such cultural practice aids in moisture conservation and improvement of plant growth. It is reasonable to suppose that the mice on such mulched areas benefited during the July-August dry spell. So, with (1) an uneven breeding-stock beginning, (2) followed by variable habitat conditions, and (3) with no outside population pressure resulting in drift, it was not surprising to find two favorable habitats in September only a few miles apart, one with 50 *Microtus* per acre, the other with three.

The high population records in May, 1940, were in northern New York, and it is in this same region that the highest September population of 78 *Microtus* per acre was recorded.

The *Microtus* population in September, 1940, was generally low but exhibited extreme variations. The general mouse population had not increased over the figures for September, 1939; however, the distribution was more variable. Infestations of 10 per acre were usual; but in every sector very localized infestations of 75 to 150 per acre were encountered. The 1940 breeding season was not too favorable for increase despite the improved cover and food conditions over the preceding year. From the investigations made, only 32 percent of the best *Microtus* habitats were infested. In other words, population pressures have not reached a point where *Microtus* occupy more than half of the best habitats, thus leaving marginal areas almost devoid of mice.

Studies from other years of rapidly expanding population indicate that the number of immature mice is triple that of breeding adults. The records for September, 1940, show that the number of breeding adults exceeded that of immature mice by a small margin. (*Microtus* below 28 grams in weight are considered immature, as it is exceedingly uncommon to find pregnancy below that level.)

At the time of the September, 1940, census, 66.2 percent of the adult females were found to be pregnant, the average litter size being 5.17. On the basis of no deaths, the population reported would have doubled by October 1.

Rabbit Repellent Study

To determine the efficiency of rabbit repellents and the effect of these materials on the cellular structure of the trees, numerous tests have been started. The repellents being used are developed by the Fish and Wildlife Research Laboratory.

Tests were first made under cage conditions at the University experimental rabbit pens at Storrs, and later field applications were made on trees in the University experimental orchard, the Hale Orchard in Oxford, Connecticut, and Gardner's Nurseries in Rocky Hill, Connecticut. During the coming year more extensive tests will be made, using spray and brush applications on a variety of trees and shrubs frequently damaged by rabbits.

During the spring of 1939, 40 apple trees (three-fourths-inch to one-inch stock) of various varieties were planted in the University experimental rabbit pens. Four pens were available and 10 trees were planted in each pen. These pens are 15 feet by 30 feet and have a heavy vegetative cover as well as considerable sprout growth. Piles of pine boughs have been placed in each pen to provide protection during the winter months. Repellents were applied as a paint to 22 trees and 18 trees were left untreated for checks. Frequent inspections are being made regarding the effectiveness of repellents as well as their effect upon the cellular structure of the plants.

One field application was made on apple and peach trees at the University experimental orchard during the spring when the newly planted trees were in a growing stage. Fall applications were made on apple trees in the Hale Orchard and Gardner's Nurseries. Two hundred fifteen trees were treated in the Hale Orchard and 50 trees were treated in Gardner's Nurseries. In both cases severe rabbit damage was being done at the time of application.

REPORT ON PARASITE WORK FOR 1940

Philip Garmàn, J. C. Schread, W. T. Brigham and G. R. Smith

During 1940, as in previous years, parasite work was carried on in cooperation with the Connecticut Pomological Society and the U. S. Bureau of Entomology and Plant Quarantine.

Oriental Fruit Moth Parasites

We received 73 orders for parasites from peach growers and placed a total of 119 colonies representing 66,185 individuals, all *Macrocentrus ancylivorus*. Extensive egg, twig and band collections were made in order to determine the degree of parasitism that occurred throughout the State. In this work, 14,000 twigs were collected, bands were placed in 22 orchards, and egg collections were made in 32. Egg parasitism was low in June, increased to a high point during July, and receded to moderate figures in August. There was great variation from orchard to orchard. Larval parasitism was likewise low in June and highest in July collections, and showed similar variation in degree from orchard to orchard. Infestation counts continue to show correlation between size of population combined with degree of parasitism and fruit infestation. Figures for four orchards where complete data were obtained are shown in Table 7. One of these orchards (Hanford) showed a very high infestation last year and observations indicate that it is being brought under control by parasites. In this 300-tree orchard, a total of 1,800 parasites (*Macrocentrus*) were placed on the following dates during 1940: June 14, July 8, July 10, and July 25.

Band collections made in August indicate that many parasites were present in numerous orchards and that secondary parasites were scarce. Table 8 gives an idea of the amount of parasitism as determined by band collections. The method consists of placing corrugated paper bands on the trunks about one foot from the ground and removing them before the moths emerge, usually in about one month. It is believed that orchards showing low parasitism in band collections will need particular attention in 1941.

TABLE 7. ORIENTAL FRUIT MOTH PARASITE WORK — 1940

Orchard	Population estimate[1]	Rating after deducting losses from parasites[2]	Percentage infested fruit at harvest
Bussa	15.0	1.89	2.1
Andrews	29.5	8.6	15.2
Hanford	45.0	5.0	15.2
Musante	44.7	18.7	73.5[3]

[1]Estimate based on number of fruit moth eggs collected per hour on several dates during July and adjusted to conform with collection of larvae in tips during the same period — also on an hourly basis.

[2]Obtained by deducting from column headed "Population estimate" the percentage egg, larval and pupal parasitism as determined by laboratory breeding from field collected tips.

[3]Short crop and later variety than Elberta possibly account for the high infestation in part.

TABLE 8. PARASITISM DETERMINED BY BAND COLLECTIONS DURING AUGUST — 1940

Orchard and Location	Fruit Moth % parasitized
Burns — Oronoque	28.9
Farmill — Shelton	84.2
Hanford — Fairfield	71.8
Conyers — Greenwich	35.9
Hurlbut — Wilton	74.9
Warncke — Cannondale	62.1
Josephy — Bristol	48.2
Andrews — Glastonbury	75.6
Bussa — Glastonbury	80.8
Rogers — Southington	36.7
Root — Farmington	27.5
Pero — Manchester	69.5
Peters — Hamden	92.4
Platt — Milford	67.5
Musante — Seymour	3.7

Recoveries. A great many parasites were found during the course of the 1940 work. *Inareolata (Dioctes) molestae* was recovered in eight orchards, and *Bassus diversus* in only one (Table 9). There is some indication that *Inareolata (Dioctes) molestae* may survive longer than formerly suspected, but our data are too meager to draw conclusions at the present time. Our best results with this parasite appear to be in the Pytka and Spicer orchards, which are adjacent. Here the parasitism has continued at about the same level during 1939 and 1940. Recoveries of *Bassus diversus* in 1940 were disappointing compared with those in 1939.

Breeding. During 1940 Mr. A. DeCaprio collected a large quantity of strawberry leaves infested with parasitized leaf rollers in New Jersey, and as a result we doubled the usual production of *Macrocentrus ancylivorus.* Considerable credit is due Mr. DeCaprio for the way the work was handled. Miss Mary A. Root assisted in laboratory work during both 1939 and 1940. Her help has released men from the laboratory, increasing the amount of field work possible.

TABLE 9. FOREIGN PARASITE RECOVERIES — 1940.

Orchard and location	Date of last liberation	Number of specimens
Inareolata (Dioctes) molestae		
Musante — Seymour	1939	(2 males (4 females
Kneuer — Guilford	1933	(1 male (1 female
Farmill — Shelton	none	(1 male (1 female
Pytka — Deep River	1938	(7 males (1 female
Spicer — Deep River	1938	(5 males (7 females
Harwig — Mill Plain	1938	(1 male (4 females
Josephy — Bethel	1939	1 male
Shepard — Danbury	1938	2 males
Bassus diversus		
Orkil — W. Simsbury	1939	1 female

Japanese Beetle Parasites and Disease

This work was carried out entirely in cooperation with the U. S. Bureau of Entomology and Plant Quarantine, on whom we have been dependent for supplies of parasites and disease. During the season, locations were scouted and dug to determine grub infestations. Twenty-five colonies of *Tiphia vernalis* were liberated. Localities where previous liberations (with a few exceptions) had been made were scouted. *Tiphia vernalis* was recovered in six localities and parasites, presumably this species, were observed in three others. It is apparent that at least one colony has become well established in Bridgeport and is spreading rapidly.

Investigation of the larval disease recommended for control by the Federal Bureau was started. Inoculation work consisted of injecting the disease into 15,000 to 20,000 grubs which were then sent to Moorestown for processing and mixing with talc carrier. A total of 15 one-acre plots have now been laid out in different parts of the State and systematic diggings are being made to determine the progress of the disease.

In addition to this work, laboratory inoculations of the Asiatic beetle were made successfully, and several field plots laid out near New Haven.

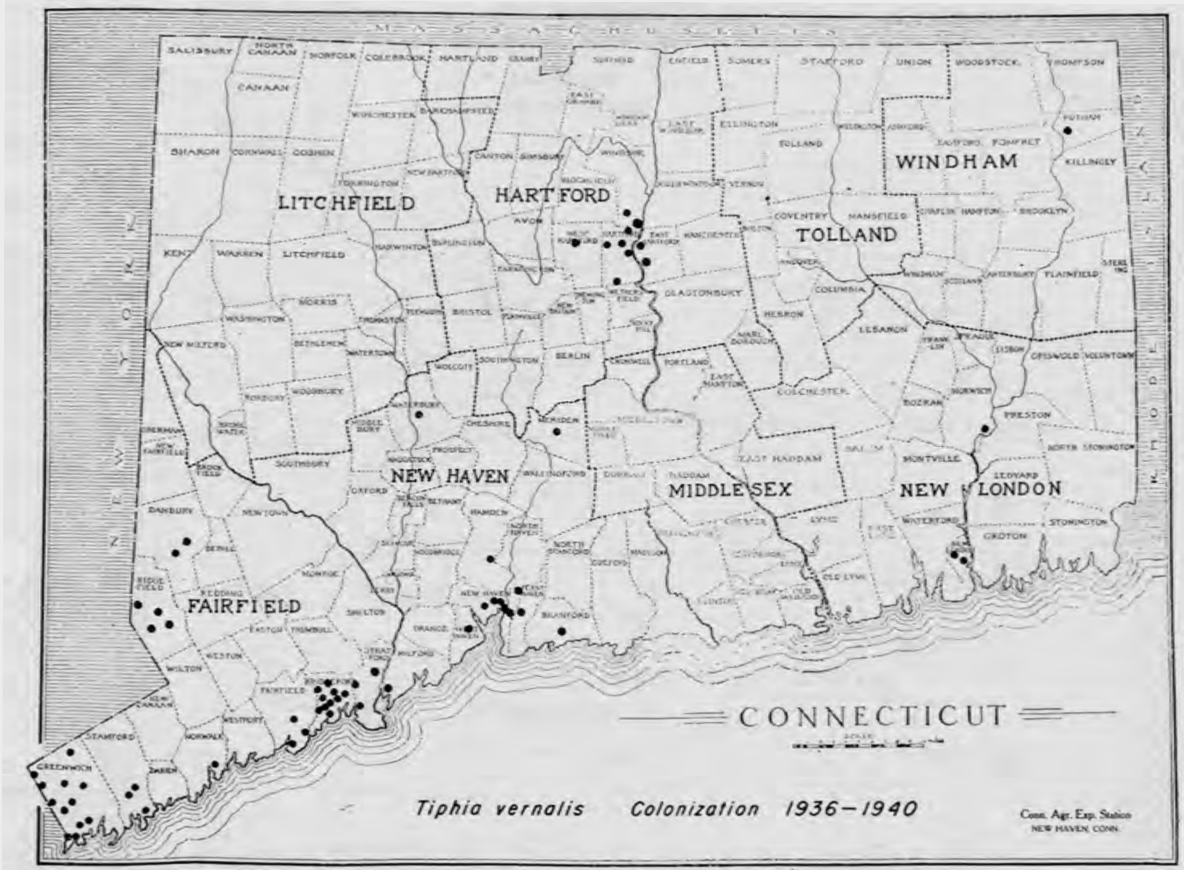

FIGURE 1. *Tiphia vernalis* colonization 1936-1940. Colonies supplied by the U. S. Bureau of Entomology and Plant Quarantine. Sites located by the Connecticut Agricultural Experiment Station.

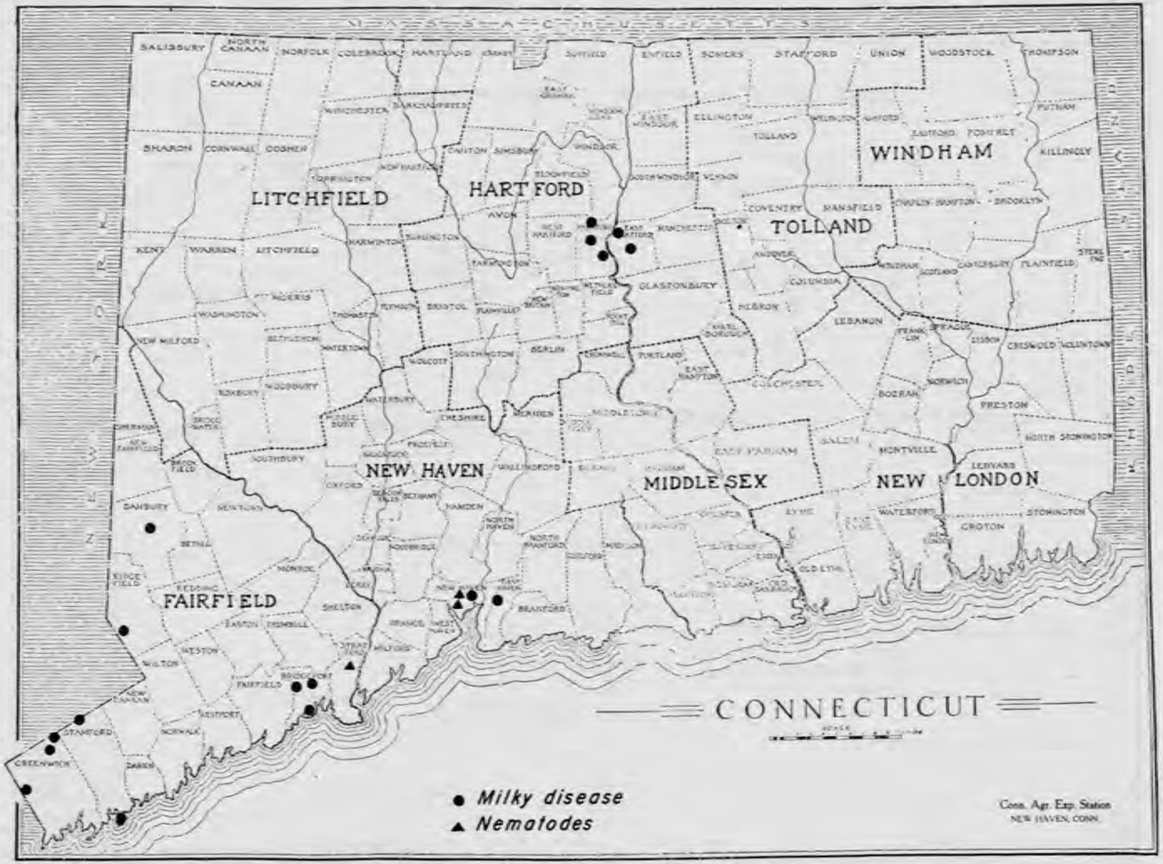

FIGURE 2. Location of disease and nematode plots, laid out during 1940.

Nematode Parasites

Through the courtesy of the New Jersey Department of Agriculture we secured a quantity of nematodes for experimental lawn treatments against Asiatic and Japanese beetles. As with the disease work, it is too early to make any statement regarding effectiveness of the treatment. Altogether four plots were laid out.

The outline maps (Figures 1 and 2) show the location of nematode and disease plots as well as *Tiphia vernalis* liberations.

CONTINUED STUDY OF STICKERS FOR SPRAY MATERIALS

Philip Garman and C. E. Shepard

During the 1940 season experiments were continued with stickers for lime-lead arsenate and lead arsenate alone. As in previous years oils seem to increase the amounts adhering after one month in the case of lime-lead arsenate combinations, but aluminum sulfate and aluminum acetate have closely approximated the results obtained with oils. The percentages remaining are shown in Table 10, which gives comparative figures for the last three years. The percentage gain in many cases is not large and would probably not be reflected in readily observable increases in insect control. However, in a complete schedule of lime-lead arsenate sprays where three or more applications are made, this difference might easily become important.

In another series, "dynamite" sprays have been used with the idea of reducing the total number of sprays applied throughout the season. In addition, for the first time this year, we used a modified formula containing aluminum acetate[1] and a small amount of benzoic acid. It has been found possible to emulsify white oils with this combination in place of soaps or other agents. Results of insect control and sticking properties have been gratifying, the new mixture comparing favorably with "dynamite". It was noted during the season that the modified formula did not show the leaf drop that was evident on the "dynamite" treated trees, and as a result the fruit appeared to be larger at harvest. All trees were thinned alike during the season to avoid discrepancies occurring from varying amounts of fruit. The size of apples is reflected in the number per 100 pounds (last column of Table 11).

In the "dynamite" series only three sprays were applied, whereas the normal summer schedule calls for six and some growers apply

[1]The Department of Analytical Chemistry reports this to be aluminum acetoborate.

more than that. The situation for the experiment is an extremely difficult one from the standpoint of both curculio and apple maggot control. Table 11 gives the figures obtained from examination of the fruit at harvest, and indicates that the modified formula is fully as good as the straight "dynamite" sticker. The type of cover is different, however, the poison being deposited in spots instead of being continuous (Figure 3). Various growers examined the trees during August and expressed satisfaction with the foliage and fruit.

FIGURE 3. Spray residue remaining on apple foliage sprayed with modified dynamite on June 12. Photograph made September 16.

It is evident, however, that much more work needs to be done with this type of material before it can be considered of commercial value. There is, for example, the fungicide problem, which, although partly solved with the mixture, is not solved for situations where scab is serious or for varieties that scab badly, such as McIntosh. This and other problems need attention before this promising mixture can be released from the experimental field.

TABLE 10. COMPARISON OF STICKERS FOR LIME-LEAD ARSENATE.

Year	Sticker	% As_2O_3[1] remaining after 1 month	Year		% As_2O_3 remaining after 1 month	% gain for sticker
1940	Fish oil	25.7	1940	Check	22.8	2.9
1940	" "	45.8	1940	"	45.7	.1
1939	" "	22.0	1939	"	14.0	8.0
1939	" "	51.0	1939	"	35.0	16.0
1938	" "	25.4	1938	"	13.6	11.8
1938	" "	47.4	1938	"	25.4	22.0
1939	Perilla oil	28.0	1939	"	14.0	14.0
1939	" "	65.0	1939	"	35.0	30.0
1939	Soybean oil	21.0	1939	"	14.0	7.0
1939	" "	60.0	1939	"	35.0	25.0
1939	Aluminum sulfate	25.0	1939	"	14.0	11.0
1939	" "	61.0	1939	"	35.0	26.0
1940	Aluminum acetate	48.0	1940	"	45.7	2.3
1940	" "	28.1	1940	"	22.8	5.3

[1]Analyses made immediately following sprays and again at the end of one month.

TABLE 11. SUMMARY OF RESULTS WITH DYNAMITE SPRAYS — 1940. VARIETY, BALDWIN.

Tree	Total fruits per tree	% clean	% curculio	% codling moth	% maggot	Apples per 100 lbs.	Treatment
M6	3371	70.1	22.2	2.4	13.9	299	Western "dynamite"
L6	3583	72.0	23.5	4.5	6.0	369	3 sprays
Averages		71.0	22.8	3.4	9.4	334	
M7	5223	83.2	11.5	3.5	8.0	281	
L7	3950	70.2	18.5	4.0	4.0	275	Modified "dynamite"
M8	2544	77.5	12.9	6.1	4.0	296	3 sprays
L8	4636	74.6	20.3	3.9	7.8	297	
Averages		76.3	15.8	4.3	5.7	287	
L9	1053	8.4	72.7	29.6	70.0	......	Check — no spray

Treatment —

Modified "dynamite" as follows:

Aluminum acetate	1 lb.
Benzoic acid	.25 lb.
White mineral oil	1 qt.
Lead arsenate	1.5 lbs. (doubled at Calyx spray)
Water	50 gals.

Western "dynamite":

White oil with 5% oleic acid	½ gal.
Monoethanolamine .7% solution	½ pt.
Lead arsenate	3 lbs. (6 lbs. at Calyx)
Water	100 gals.

Sprays applied: May 17 (Pink), May 29 (Calyx), June 12 (1st Cover)

TABLE 12. ADHESION OF ARSENIC IN DYNAMITE SPRAY TESTS — 1940. FIGURES ARE MICROGRAMS As_2O_3 PER 100 ONE SQ. CM. DISCS.

Tree	Dates of Examination 6/16	7/16	8/16	9/16	% As_2O_3[1] remaining 9/16	Treatment
M6	2858	2571	1431	1612	56.4	Western "dynamite"
M7	2331	2571	2000	1725	74.0	Modified "dynamite"
N6	2369	2047	1875	1463	61.76	Western "dynamite"
N7	2124	2161	1741	1500	70.6	Modified "dynamite"

[1]Percentage of the amount found by analysis to be present on the foliage June 16.

NOTES: Spray schedule given in Table 11.
Rainfall June 16 - Sept. 16, 8.66 inches.

EXPERIMENTAL CONTROL OF THE ORIENTAL FRUIT MOTH

PHILIP GARMAN

Through cooperation with Mr. Walker of the General Chemical Company of New York, a quantity of an insecticide known as "Genicide" was obtained for experiment. This material was analyzed by Doctor Fisher of the Department of Analytical Chemistry and found to contain Xanthone. Cooperative experiments were conducted, using two commercial orchards and the Experiment Station plot at Mount Carmel. The plots at Mount Carmel and Milford were set up so that counts could be made of fruit from adjacent sprayed and unsprayed trees in different parts of the orchard. These data are set forth in Tables 13 to 15. From them, it is apparent that there was considerable gain in fruit free of new injury. While this was not great enough to be practical in the case of the Hale Orchards, there is considerable consistency throughout the experiment. In the case of Platt's at Milford, the fruit approached a reasonably satisfactory point. The difference between treated and checks appeared to be very significant by statistical analysis.

The orchards at Mount Carmel and Milford were sprayed with our Experiment Station outfit. Applications at Seymour were made by Mr. Scott of the Hale Orchards.

In order to check more fully on the field results, laboratory tests were conducted using small green apples and infesting them artificially by placing a number of fruit moth eggs on each. Analysis of variance indicates that the difference among treatments is significant, and that Genicide is better than either checks or lead arsenate (Table 16).

TABLE 13. ORIENTAL FRUIT MOTH CONTROL — 1940.
PLATT'S ORCHARD, MILFORD. PICKED FRUIT — ELBERTA.

Sprayed		Unsprayed		Difference	
Tree plot	Percent "new" injury	Tree plot	Percent "new" injury	Tree plot	Percent
1	5.8	1	33.0	1	27.2
2	8.4	2	24.4	2	16.0
3	8.1	3	24.1	3	16.0
4	13.3	4	44.3	4	31.0
5	10.5	5	25.6	5	15.1
6	5.2	6	24.3	6	19.1
7	8.8	7	23.4	7	14.6
8	16.5	8	36.1	8	19.6
9	3.0	9	29.5	9	26.5
10	12.5	10	23.4	10	10.9
Average	9.2%		28.8%		19.6%

Control approaching satisfactory from a commercial standpoint.

Four sprays applied as follows: August 5, August 13, August 23, and September 10. Genicide diluted 2 lbs. to 100 gals. water.

TABLE 14. ORIENTAL FRUIT MOTH CONTROL — 1940.
EXPERIMENT STATION FARM, MOUNT CARMEL. PICKED FRUIT — ELBERTA.

Unsprayed		Sprayed		Difference	
Tree plot	Percent "new" injury	Tree plot	Percent "new" injury	Tree plot	Percent
1	2.3	1	.9	1	1.4
2	7.0	2	.0	2	7.0
3	5.3	3	.8	3	4.5
4	2.2	4	1.8	4	.4
5	4.5	5	1.0	5	3.5
6	3.1	6	3.4	6	-.3
7	3.7	7	1.7	7	2.0
8	1.8	8	1.1	8	.7
9	2.1	9	1.1	9	1.0
10	4.1	10	1.1	10	3.0
11	5.1	11	2.4	11	2.7
12	.9	12	.6	12	.3
13	7.8	13	3.6	13	4.2
Averages	3.8%		1.5%		2.3%

Sprays same as in preceding table.

TABLE 15. ORIENTAL FRUIT MOTH CONTROL — 1940.
HALE ORCHARDS, SEYMOUR. PICKED FRUIT.

Tree	Percent "new" injury Sprayed	Tree	Percent "new" injury Checks	Tree	Difference %
1	39.9	1	52.0	1	12.1
2	29.7	2	36.6	2	6.9
3	33.9	3	58.1	3	24.2
4	15.3	4	46.6	4	31.3
5	14.1	5	67.4	5	44.3
6	32.7	6	68.4	6	36.7
7	30.5	7	53.1	7	22.6
Averages	28.0%		54.6%		25.4%

Average "new" injury from all fruit cut from

Sprayed plots	31.1%	and	30.2%
Check areas	48.3%	and	70.8%
Differences	17.2%	and	40.6%

NOTES: Control still considered unsatisfactory here because of the high infestation in sprayed plots.

"New" injury does not include conspicuous second generation work which would have been done before spray operations began.

Three sprays applied approximately August 5, 15 and 25.

Dilution same as in two preceding tables.

TABLE 16. CONTROL OF THE ORIENTAL FRUIT MOTH.
LABORATORY, 1940.

Lead arsenate 3 lbs. to 100 gals.			Genicide (Xanthone) 2 lbs. to 100 gals.			Check — no treatment		
Eggs used	Larvae matured	%	Eggs used	Larvae matured	%	Eggs used	Larvae matured	%
30	5		40	4		33	20	
30	14		30	2		36	19	
29	23		36	2		36	12	
19	7		35	0		28	28	
32	16		37	3		44	17	
25	17		38	1		177	96	54.2
36	7		37	1				
37	24		39	10				
40	17		33	2				
38	20		39	2				
316	150	47.4	368	25	6.8			

General summary of the experiment

	% matured
Check — no treatment	54.2
Lead arsenate	47.4
Genicide (Xanthone)	6.8

NOTES: Green apples about 1 inch in diameter were punctured with 30 holes each, the bottoms tanglefooted and the calyces paraffined. Thirty to forty Oriental fruit moth eggs were then placed on each apple and allowed to hatch. The figures in the "eggs used" column represent only those eggs that hatched. After the larvae had entered, the apples were each placed in an individual jar and kept in an incubator until the larvae left the fruit and spun their cocoons.

Formulae: Lead arsenate 1.5 grams in 416 ml. water. Genicide 1 gm., sodium oleate .5 gm., and zinc sulfate (monohydrate) .125 gm. in 416 ml. water.

Table 17. Oriental Fruit Moth Control — 1940. Laboratory Experiments.

Treatment	Number eggs hatched	Number entered	Percent entered
Check — no treatment	295	132	44.7
	400	191	47.7
	392	157	40.0
Totals and averages	1087	480	44.1
Genicide	228	14	6.1
	282	74	26.2
	230	68	29.5
	1043	13	1.2
Totals and averages	1783	169	9.4
Lead arsenate	243	78	32.0
	201	73	36.3
Totals and averages	444	151	34.0

Procedure — 60 holes made in small apples about 1 inch in diameter; apples then tanglefooted below and Oriental fruit moth eggs placed on top. "Entries" determined by digging into the fruit several days after hatching.

EXPERIMENTAL CONTROL OF THE APPLE MAGGOT

Philip Garman

Continued study of the apple maggot in 1940 gave interesting results.

Laboratory Work

Our laboratory work consisted largely of attempts to determine whether rotenone dusts could be improved, especially in their resistance to action by light. A commercial sun lamp was obtained for this purpose. The source of light in this apparatus is an S_4 Mazda bulb, furnishing ultra violet rays said to be considerably stronger than sunlight. Material tested was dusted on 3.25 × 4.25-inch glass slides and placed 12 inches from the bottom of the bulb. After the period of exposure the slides with exposed dust were placed in small cages where they served as windows, with the insecticide turned inwards. Counts of dead and paralyzed flies were made after 24 and 48 hours. In some cases the slides were replaced by clean ones after 48 hours and the reading taken two days later.

Experiments given in Table 18 were made with stabilized derris compared with unstabilized derris from the same source, the dusts being mixed both with and without white lubricating oil. The amount of material on each slide was weighed carefully. The figures obtained do not show any striking differences in favor of the stabilized derris and the data were analyzed statistically by Dr. C. I. Bliss without discovering significant differences.

A number of materials were then tried for reducing the effect of light, some of which appeared promising. Dusts with 10 percent lamp black were not destroyed as rapidly, a fact well known since the work of Campbell. However, dusts made up with iron hydroxide appeared to be better than those with lamp black (Table 19), and this led to an investigation of red clays for the purpose. One of these, known as Hall clay from the United Clay Mines of Trenton, offers some promise. Formulae were made up with this red clay instead of pyrophyllite and exposed to rays of the sun lamp, Tables 20 - 22. In these tests there appears to be a consistent advantage for the red clay which increases with length of exposure to the sun lamp within the experimental limits. Later, exposed and unexposed slides were submitted for chemical analyses to the Department of Chemistry. Doctor Fisher's report is given in Table 23. The results confirm our biological tests showing definitely that rotenone is less rapidly destroyed when mixed with the red clay.

A number of new materials have been tested, some of which show toxicity for the apple maggot fly. Perhaps the most promising of these are pyrethrum-oil dust, two soluble antimony compounds, and Phthalonitrile. Acetone semicarbazone also has some toxicity. Pyrethrum-oil is not quite so efficient as rotenone dusts though it has some repellent or deterrent action, reducing the number of egg punctures in the fruit. The materials have not been sufficiently studied to comment further.

Field Studies

Field experiments were conducted in two different orchards using rotenone dusts prepared from derris by Apothecaries Hall Company of Waterbury. These dusts, prepared to contain .5 percent rotenone, were analyzed by Doctor Fisher and reported to contain one and a fraction percent of rotenone, a figure probably high because of the presence of deguelin which is not separated in the analyses. Counts continued to show control of the apple maggot in the Burton orchard at Mount Carmel, Tables 24 and 26, and indicate fairly consistent results for the last three years. We also employed here some rotenone dust with lamp black but were forced to discontinue it after two applications, owing to unfavorable appearance of the fruit.

In the Westwoods Orchard, Cortlands, very heavily infested in 1939, were dusted six times. The infestation on dusted trees was considerably reduced in spite of the fact that the orchard as a whole was heavily infested and nearly all untreated fruits dropped from the trees by September (Table 25).

It is evident that .5 percent rotenone-oil dusts may have a place for late season work, especially since flies were seen this year in various orchards until late in September. The rapidity of destruction of the insect continued to be apparent, although loss of effectiveness occurred within four or five days, after which period flies could again be seen in the trees. It is with this in mind that experiments are being continued.

TABLE 18. EXPERIMENT TO DETERMINE VALUE OF A "STABILIZED" DERRIS. MORTALITY OF APPLE MAGGOT FLIES IN LABORATORY CAGES — 1940. MATERIAL EXPOSED TO S. SUN LAMP AT UNIFORM DISTANCE FROM INSECTICIDE (12 INCHES).

Date	Expt. number	Material	Exposure to light in hours	Mortality 24 hours	Mortality 48 hours	Number flies in cage	Weight of material on slide, grams
Jan. 16 - 18	D	1	0	17	17	17	.0052
		2	0	17	17	17	.0041
		3	0	22	22	22	.0059
		4	0	19	19	19	.0055
Jan. 17 - 19	F	1	2	11	13	13	.0049
		2	2	8	11	18	.0046
		3	2	14	15	19	.0048
		4	2	10	13	16	.0054
Jan. 18 - 20	G	1	2	12	19	19	.0054
		2	2	9	12	20	.0051
		3	2	14	14	14	.0030
		4	2	17	19	19	.0050
Jan. 18 - 20	H	1	2	13	18	20	.0057
		2	2	6	13	20	.0053
		3	2	9	14	22	.0049
		4	2	6	12	19	.0053
Jan. 18 - 20	I	1	2	6	10	17	.0041
		2	2	6	10	19	.0058
		3	2	6	11	18	.0047
		4	2	5	9	19	.0047
Jan. 16 - 18	E	1	4	2	7	18	.0045
		2	4	0	2	19	.0043
		3	4	1	4	19	.0047
		4	4	4	5	19	.0041
Jan. 15 - 17	C	1	8	0	3	12	.0041
		2	8	0	0	15	.0045
		3	8	0	1	19	.0033
		4	8	0	1	21	.0044
Jan. 13 - 15	A	1	20	0	0	17	.0037
		2	20	0	0	17	.0030
		3	20	0	0	22	.0023
		4	20	0	0	19	.0026

NOTES: Insecticide dusted on slide with settling tower and exposed to action of S. Mazda bulb 12 inches from the plate. Slides so treated were used to make a window in a small cage with the insecticide turned inwards. Data analyzed by statistical methods show no significant differences.

Formula No. 1. Unstabilized derris, 10 gms.; pyrophyllite, 90 gms.
" No. 2. Stabilized derris, 10 gms.; pyrophyllite, 90 gms.
" No. 3. Unstabilized derris, 10 gms.; pyrophyllite, 86 gms.; 85 vis. white oil, 4 gms.
" No. 4. Stabilized derris, 10 gms.; pyrophyllite, 86 gms.; 85 vis. white oil, 4 gms.

TABLE 19. COMPARISON OF THREE DUST FORMULAE FOR KILLING APPLE MAGGOT FLIES. LIGHT EXPOSURE 20 HOURS, S_1 SUN LAMP.

Dates	Formula	Mortality 48 hrs. %	Formula	Mortality 48 hrs. %	Gain for No. 7 over No. 12 %
Feb. 12-16, 1940	12	46	7	41	+ 6
Feb. 10-14, 1940	12	30	7	78	+ 38
Feb. 1-3, 1940	12	41	7	73	+ 32
Feb. 1-3, 1940	12	44	7	100	+ 56
Feb. 10-14, 1940	1	0			
Feb. 12-16, 1940	1	0.7			
Jan. 13-15, 1940	1	0			

NOTES: Formula No. 7 contains (90%) Ferric hydroxide, .5% rotenone.
" No. 12 contains 10% lamp black, 80% pyrophyllite, .5% rotenone.
" No. 1 contains 90% pyrophyllite, .5% rotenone.

TABLE 20. COMPARISON OF PYROPHYLLITE (FORMULA 1) AND HALL CLAY (FORMULA 15) AS CARRIERS FOR ROTENONE. SUMMER 1940.

Light[1] exposure	Mortality in 48 hours Formula 15 %	Formula 1 %	Gain for No. 15 %
4 hours	96.1	92.5	3.6
8 hours	92.2	86.9	5.3
16 hours	61.5	20.1	41.4
24 hours	62.8	10.7	52.1

[1]Sun lamp, S_4 bulb, 12 inches from slide with insecticide. .5% rotenone in both formulae.

TABLE 21. COMPARISON OF TWO DUST FORMULAE FOR KILLING APPLE MAGGOT FLIES. LABORATORY TESTS, 1940 — .5% ROTENONE IN ALL FORMULAE.

	Formula No. 1			Formula No. 15			Gain for
Date	Number of flies	Mortality 48 hrs.	% kill	Number of flies	Mortality 48 hrs.	% kill	No. 15 %
			8 hour exposure to sun lamp				
Aug. 12	21	16	76.1	19	16	84.2	+ 8.1
Aug. 12	10	8	80.0	12	11	91.6	+ 11.6
July 26	20	20	100.0	15	15	100.0	00.0
July 26	24	22	91.6	20	19	95.0	+ 3.4
			16 hour exposure				
Feb.	18	1	5.5	15	10	66.6	+ 61.1
Mar. 6	17	4	23.5	16	11	68.7	+ 45.2
Mar. 1	14	1	7.1	21	20	95.2	+ 88.1
July 29	13	4	30.7	15	9	60.0	+ 29.3
July 29	13	4	30.7	14	10	71.4	+ 40.7
Aug. 1	12	4	33.3	18	14	77.7	+ 34.4
Aug. 1	17	2	11.8	13	10	77.9	+ 66.1
			24 hour exposure				
Aug. 8	20	6	30.0	20	17	85.0	+ 55.0
Aug. 8	17	2	11.7	13	8	61.5	+ 49.7
Aug. 3	15	0	0.0	28	14	50.0	+ 50.0

NOTES: Formula No. 1 — Derris (5% rotenone) 10 grams, pyrophyllite 90 grams.
" No. 15 — Derris (5% rotenone) 10 grams, Hall clay (red) 90 grams.

TABLE 22. COMPARISON OF DIFFERENT STRENGTHS ROTENONE IN RED AND WHITE CARRIERS, EACH EXPOSED 24 HOURS TO S₄ MAZDA SUN LAMP.

Experiment	Number of replicated tests	Carrier	% rotenone	Average mortality 48 hrs.
1	6	Pyrophyllite (white)	.5	49.2
2	6	"	1.0	58.2
3	5	"	2.0	89.4
5	4	Hall Clay (red)	.25	40.7
6	5	"	.50	70.5
7	4	"	1.0	92.5

TABLE 23. RESULT OF CHEMICAL ANALYSES[1] FOR LIGHT EXPOSED ROTENONE DUSTS COMPARED WITH UNEXPOSED.

Carrier	Color	Exposure to sun lamp	Weight on slides	Rotenone found	% rotenone
Pyrophyllite	White	None	.0061 gm.	.00016 gm.	2.5
	"	"	.0053	.00011	2.0
	"	"	.0069	.00019	2.8
	"	"	.0057	.00019	2.9
	Averages		.0060 gm.	.000156 gm.	2.5
Pyrophyllite	White	24 hours	.0065 gm.	.00005 gm.	.8
		" "	.0062	.00007	1.2
		" "	.0066	.00009	1.3
		" "	.0068	.00008	1.2
	Averages		.00652 gm.	.00007 gm.	1.1
Hall Clay	Red	None	.0066 gm.	.00014 gm.	2.1
			.0062	.00011	1.8
			.0072	.00016	2.2
	"	"	.0074	.00017	2.3
	Averages		.00685 gm.	.000145 gm.	2.1
Hall Clay	Red	24 hours	.0072 gm.	.00010 gm.	1.4
		" "	.0072	.00012	1.6
	"	" "	.0065	.00010	1.5
	"	" "	.0064	.00010	1.6
	Averages		.00682 gm.	.000102 gm.	1.5

Percentage reduction of rotenone by 24-hour sun lamp exposure:

Hall Clay (red)	28.6
Pyrophyllite (white)	57.3
Difference in favor of Hall Clay	28.7%

[1]Chemical analyses by Dr. H. J. Fisher of the Dept. of Analytical Chemistry.

TABLE 24. CONTROL OF APPLE MAGGOT — 1940.
BURTON ORCHARD, MOUNT CARMEL.
VARIETY — GRAVENSTEIN.

Tree	Number cut open	Infested	% infested	Treatment
			Picked fruit	
14	155	12	7	
1	200	12	6	
2	160	6	3	
3	180	25	13	
4	180	13	7	
5	140	6	4	
6	160	20	12	
7	160	20	12	5 dusts of oil-rotenone-pyrophyllite
8	180	10	5	July 5, 15, 25, August 1, 14
9	·200	9	4	
10	239	3	1	
11	170	11	6	
12	120	20	16	
13	100	3	3	
14	155	12	7	
Totals	2344	170	7.2	
			Dropped fruit	
1	160	34	21	
2	120	23	19	
3	160	40	25	
4	120	26	26	
5	100	21	21	
6	120	20	17	
7	160	41	24	
8	160	90	56	Same as above.
9	160	41	31	
10	140	36	26	
11	140	33	24	
12	100	25	25	
13	40	12	30	
14	100	20	20	
Totals	1780	462	25.9	
			Picked and Drops	
Checks	120	105	87.5	None

TABLE 25. CONTROL OF APPLE MAGGOT — 1940.
Westwoods. Variety — Cortland.

Tree	Number cut open	Infested	% infested	Treatment
		Picked fruits — Dusted		
B 1 1	200	131	65.5	
B 2 2	150	130	86.6	
B 3 3	200	189	94.5	
B 5 4	200	122	61.0	
B 7 5	200	81	40.5	
B 9 6	200	140	70.0	6 dusts of .5% oil-rotenone dust
B 11 7	200	107	53.5	July 5, 15, 25, August 1, 8, 26
B 13 8	200	140	70.0	
B 15 9	200	88	44.0	
B 17 10	200	148	74.0	
B 19 11	200	96	48.0	
Totals	2150	1372	63.7	Gain + 35.6% in sound fruit
		Picked fruits — Check		
D 3 12	140	140	100	
D 19 13	55	54	98	
O 20 14	300	300	100	
L 15 15	200	199	99	No maggot sprays or dusts
L 17 16	200	199	99	
L 21 17	200	200	100	
Totals	1095	1092	99.3	
		Infestation in dusted plot during 1939		
B 2 2	100	94	94	
B 5 4	100	97	97	
B 9 6	100	97	97	
B 13 8	100	99	99	No maggot sprays or dusts
B 17 10	100	99	99	
Totals	500	486	97.2	

NOTES: Treatment covered 29 trees out of approximately 180 in the orchard. Additional sources of infestation included orchards on neighboring property only a short distance from the dusted plot. Crop in 1940 about ⅓ that of 1939.

TABLE 26. APPLE MAGGOT CONTROL, 1938-1940.
BURTON ORCHARD, MOUNT CARMEL. VARIETY — GRAVENSTEIN.

Treatment	Year	Kind of fruit	Percent injured by maggots
.5% rotenone dust	1938	Drops	37
4 applications	1938	Picked	16
.5% rotenone-oil-pyrophyllite dust	1939	Drops	21
4 applications	1939	Picked	3
.5% rotenone-oil dust	1940	Drops[1]	26
5 applications	1940	Picked[1]	7

[1]Checks in this orchard during 1940 showed 87.5 percent infested fruit. All fruit dropped from the trees before counts could be made.

NOTES ON THE CODLING MOTH IN CONNECTICUT

Philip Garman

Compared with other localities, the abundance of the codling moth in Connecticut is normally low. The reason for this situation is obscure but is probably linked in some way with climate or natural enemies, or both. Cool temperatures at sundown probably have considerable influence. Dampness and rainfall may also be important. We learn on reviewing the literature that outbreaks threatened during the period between 1871 and 1873. At that time P. M. Augur, Connecticut Pomologist, reported that the "Codling moth was particularly destructive in last year's fruit. The depredations of this insect are becoming more and more general." Since then we find relatively few references to it in Connecticut literature though it is mentioned in Connecticut Entomological Reports for 1903, 1904, 1917, 1920, and 1925. Experiments by Messrs. Stoddard and Zappe in 1926 indicate that an infestation of about 26 percent developed on check trees near a packing shed. This is the highest figure we have seen until last summer when one of our check trees at Mount Carmel went to 29 percent. About the only similarity in the weather between 1871 to 1873 and 1940 is the fact that all were in periods of abnormally high summer temperatures. The earlier period lasted from 1860 to 1880, whereas the present period apparently began about 1930.

Whether or not temperatures are the primary influence, it will be noted that both records of infestation came about 10 years after the beginning of the warmer summer averages. The worst infestation that I have yet seen in Connecticut occurred this year in Middlefield. In the orchard mentioned, about three acres of McIntosh were so heavily infested that the owner put in his thinning crews and picked off and destroyed all fruits. The trees in a block of some 10 to 15 acres were then scraped and banded, as well as dusted, to catch any late stragglers of the second generation. How effective this program will be remains to be seen, but the grower concerned is energetic and resourceful and, if it is at all possible, will get control of the situation.

The infestation occurred on a relatively high knoll near a packing shed. No signs of moths could be seen within the shed in spite of the fact that it was filled with apple crates at the time of inspection. Alongside the shed were piled a number of cords of wood, mainly trunks of apple trees removed from another part of the same orchard. The stumps were two years old, however, which should eliminate them as a source of trouble this year although they might have concentrated the moths during 1939.

The owner admits that some of the early sprays were skipped in 1940, and at the time of inspection little spray deposit could be found on the trees. Possibly this may be a more serious element tending to build up the population than any others, but it is evident that the insect is on the increase over the entire area, 100 - 150 acres. If the increase is due to high summer temperatures and these temperatures continue, the trouble will continue. Also, if the strain of codling moth proves to be imported from other localities where the insect is more vigorous, trouble may be expected to continue. If, on the other hand, it is merely due to concentration of moths and orchard practices, we look for a decline to its original status before long.

At least two other growers have reported codling moth damage in 1940, and the situation will doubtless be watched with increasing interest by many Connecticut growers during 1941.

OBSERVATIONS ON THE EUROPEAN CORN BORER

(*Pyrausta nubilalis* Hubn.)

R. L. Beard

To achieve satisfactory control of an insect by chemical means it is essential for the insecticide to be applied in the proper place at the proper time. In the case of the European corn borer (*Pyrausta nubilalis* Hubn.), standard procedure has been to apply dual-fixed nicotine dust to the developing whorl and to the leaf axils at five-day intervals, beginning soon after the eggs hatch. The application of the dust to the whorl and to the leaf axils, particularly those in which the ears form, is based on such observations as reported by Neiswander, Polivka, Balduf, and Huber.[1]

These workers noted that although the feeding habits change somewhat coincident with changes in the correlation between the development of the corn and the development of the insect, in general the young borers feed into the whorl at the base of the unrolling leaves. As the tassel emerges, the young larvae feed in and among the pollen buds. As the tassel grows away from the leafy portions of the plant and spreads out, the larvae leave the tassel, some of them boring directly into the stem of the plant, where they remain. Other larvae move downward to enter the stalk at a point under a leaf sheath or feed in the angle formed by the base of the leaf and the stalk. Presumably these latter larvae are those which later infest the ears, although the authors did not so specify.

In order to determine for Connecticut the feeding habits of the corn borer with a view toward improving the effectiveness of insecticidal treatment, observations on both generations of the corn borer were made during the 1940 season.

For the first generation borer, corn of the Marcross variety was planted on April 25 and May 1. As regards the feeding of the borer, the difference in plant growth due to planting dates was not sufficient to demand separate considerations of the two lots.

Three procedures were followed in tracing the activities of the borers. In one, 70 plants were dissected in groups of 10 at five-

[1] In Huber, L. L., Neiswander, C. R., and Salter, R. M. 1928. The European Corn Borer and its Environment. Ohio Agr. Expt. Sta., Bul. 429.

day intervals following the first hatching of corn borer eggs. After the first eggs hatched, subsequent eggs deposited were removed by frequent examination of the plants. In another series of 40 plants on which the first eggs alone were allowed to hatch, dissections in groups of 10 were made when the plants reached certain stages of growth, namely, plants having early ear shoots, those in silk, at the time of harvest, and plants with corn in the hard dough stage. In the third series, eggs were allowed to hatch on certain plants at one time, and on other plants at other times in such a way that throughout the oviposition season of the insect, different groups of plants became infested at different times. Portions of each group were dissected at intervals in point of time rather than at particular growth stages. At the time of dissection the stage of growth of the plant was noted and all borers were recorded both as to stage of development and as to position on the plant. In an effort to decrease migration from plant to plant, plants adjacent to those under observation were kept free from eggs except in such cases in which the infestation coincided in time with that of the observed.

Although the plants were very carefully examined at intervals frequent enough to observe eggs before hatching, it was found that an occasional egg-mass was overlooked. Moreover, it was impossible to distinguish individual borers which had migrated from plants other than those under observation except in instances where age differences were obvious. Accordingly, the data presented here show trends and not absolute relationships, particularly when comparable populations, rather than identical populations, are measured at different times. One further qualification must be made. Although 325 corn plants were dissected for the first generation borer alone, so many categories were considered that the number of plants in each was small, and in most cases the number of borers was such that the expression of the data in terms of percent represents an extension of the observed figures, and must be considered as such.

Although the first eggs to be deposited must necessarily be placed on the main portion of the plant, tillers soon develop upon which eggs are commonly laid. The effect of this upon the ultimate distribution of the borers is important in that marketable ears of corn are produced on the main stalk. On plants observed for the first generation borer, 1,842 eggs on the main portions of the plant were recorded. Dissections of the plants yielded a total of 484 borers, of which 22 percent were located in the tillers, and 78 percent in the main plant. On the other hand, 1,309 eggs were noted on the tillers of other plants. These plants upon dissection yielded 379 borers, of which 54 percent were located in the tillers and 46 percent in the main portion of the plant. These figures suggest that regardless of the position of the eggs, the borers hatching therefrom tend to distribute themselves over the whole plant, but there appears to be a greater tendency for the borers borne on the main plant to remain on the main plant than there is for the tiller-borne borers to remain on the tillers. In other words, the main stalk is apparently more attractive to the larvae. Tillers, on the other hand, appear more attractive for oviposition, as judged from a consideration of 140 egg-masses, of which 86 were deposited on tillers and 54 on the main plant. (Only plants possessing tillers were included for these figures.)

At the time of harvest, 100 infested ears of corn were examined, and the position of borer entrance was noted. In only one case had a borer reached the ear by boring from the stalk through the shank of the ear. In three cases infestation was by way of the silk. In 39 cases, entrance to the ear was made at the area of contact between the ear and the stalk. And in the remaining 57 cases, the borers entered through the exposed portions of the husk. These figures show that the possibility of borers resident in the stalk itself reaching the ear by boring through the shank is a negligible factor.

In the tabulations below, the infestation of borers in the ears and ear shoots is that with which we are most concerned. The infestation of the leaf sheaths immediately surrounding the potential ears is likewise important in that the borers are there readily available for ear attack.

Although the borers in that portion of the main stalk supporting the potentially marketable ears are recorded separately, there is little real need for it for the reason mentioned above: that larval migration from the central stalk to the ear is negligible. In fact, observation indicates that normally, borers have little tendency to leave the stalk once they become established there.

All other portions of the main stalk are grouped together, and all parts of the tillers are considered as a unit.

The following tabulation represents, at each of four stages of plant growth, the percent infestation of these plant regions, based on the total number of borers in 10 corn plants. Only the first eggs deposited were permitted to hatch.

TABLE 27. DISTRIBUTION OF BORERS IN PLANTS AT DIFFERENT GROWTH STAGES. PLANTS INFESTED EARLY IN SEASON.

	Stage of growth			
	Ear Shoot	Silk	Time of harvest	Hard dough
Number of borers	61	114	89	41
Position of borers in plant:				
Ears and ear shoots	5%	18%	33%	17%
Leaf sheaths around ears	....	6	2	5
Portion of stalk supporting ears	....	1	14	34
Other portions of main stalk	79	42	12	27
Tillers	16	33	39	17
	100%	100%	100%	100%

These figures show, for the first three stages of plant growth, an increasing concentration of borers in the ears, ear shoots, adjacent parts of the stalk, and in the tillers, with a corresponding decrease in the other portions of the main plant.

The 70 plants dissected in groups of 10 at five-day intervals following the first hatching had borers distributed as follows:

TABLE 28. DISTRIBUTION OF BORERS IN PLANTS AT DIFFERENT TIMES AFTER INITIAL INFESTATION.

	Days after first hatching						
	5	10	15	20	25	30	35
Number of borers	35	56	87	58	62	90	44
Percent borers found in:							
Ears and ear shoots	....	2%	10%	14%	36%	21%	32%
Leaf sheaths around ears	....	....	1	7	....	1	....
Portion of stalk supporting ears	....	....	1	8	18	26	25
Other portions of main stalk	89%	80	34	54	27	15	25
Tillers	11	18	54	17	19	37	18
	100%	100%	100%	100%	100%	100%	100%

These data show the same general tendency, though less definite than the above, of an increasing concentration of borers in the ears. The borer infestation in the tillers shows no definite trend. If these same data are considered in terms of stage of plant growth at the time dissections were made instead of units of time, the following relationships pertain:

TABLE 29. DISTRIBUTION OF BORERS IN PLANTS AT DIFFERENT GROWTH STAGES AFTER INITIAL INFESTATION.

	Stage of growth			
	Early Tassel	Ear shoots. No silk	Silk. No real ears	Ears
Number of borers	54	70	96	212
Percent of borers found in:				
Ears and ear shoots	....	6%	11%	27%
Leaf sheaths around ears	....	....	5	....
Portion of stalk supporting ears	....	....	5	22
Other portions of main stalk	92%	64	37	23
Tillers	8	30	42	28
	100%	100%	100%	100%

This treatment of the data emphasizes the concentration of the borer population in the ears coincident with a progressive decrease in the proportion of borers found in the other portions of the plants as growth occurs.

The data covering dissections of corn infested at different times throughout the oviposition period of the borer adult are summarized as follows:

TABLE 30. DISTRIBUTION OF BORERS FROM EGGS DEPOSITED JUNE 4 - 9.

	Date of dissection								
	6/24	6/28	7/3	7/8	7/16	7/19	7/26	7/29	8/2
Number of borers	8	12	6	22	32	27	34	9	16
Percent of borers found in:									
Ears and ear shoots....	....	....	17%	23%	22%	11%	53%	56%	12%
Leaf sheaths around ears	....	....	....	....	....	4	3	....	6
Portion of stalk supporting ears	....	....	....	....	22	7	12	22	19
Other portions of main stalk	88%	100%	83	73	28	45	23	11	19
Tillers	12	....	....	4	28	33	9	11	44
	100%	100%	100%	100%	100%	100%	100%	100%	100%

TABLE 31. DISTRIBUTION OF BORERS FROM EGGS DEPOSITED JUNE 10 - 14.

	Date of dissection						
	6/24	6/28	7/3	7/16	7/24	7/29	8/2
Number of borers	13	3	23	43	25	9	48
Percent of borers found in:							
Ears and ear shoots	....	....	....	16%	24%	45%	15%
Leaf sheaths around ears	....	....	4%	....	....	....	....
Portion of stalk supporting ears	....	....	....	16	20	22	21
Other portions of main stalk	100%	100%	35	28	36	11	25
Tillers	....	....	61	40	20	22	39
	100%	100%	100%	100%	100%	100%	100%

TABLE 32. DISTRIBUTION OF BORERS FROM EGGS DEPOSITED JUNE 14 - 20.

	Date of dissection					
	6/28	7/8	7/16	7/19	7/26	7/29
Number of borers	3	36	36	34	26	53
Percent of borers found in:						
Ears and ear shoots	....	8%	25%	44%	11%	28%
Leaf sheaths around ears	....	....	3	3	4	....
Portion of stalk supporting ears	....	....	3	6	4	19
Other portions of main stalk	100%	64	2	21	27	19
Tillers	....	28	67	26	54	34
	100%	100%	100%	100%	100%	100%

TABLE 33. DISTRIBUTION OF BORERS FROM EGGS DEPOSITED JUNE 21 - 27.

	Date of dissection			
	7/13	7/16	7/25	8/2
Number of borers	13	24	23	32
Percent of borers found in:				
Ears and ear shoots	39%	34%	22%	28%
Leaf sheaths around ears	....	4	....	....
Portion of stalk supporting ears	....	4	17	31
Other portions of main stalk	15	25	4	31
Tillers	46	33	57	10
	100%	100%	100%	100%

TABLE 34. DISTRIBUTION OF BORERS FROM EGGS DEPOSITED JUNE 28 - JULY 1.

	Date of dissection		
	7/8	7/20	7/29
Number of borers	26	36	47
Percent of borers found in:			
Ears and ear shoots	19%	36%	30%
Leaf sheaths around ears	....	3	....
Portion of stalk supporting ears	....	8	19
Other portions of main stalk	8	11	26
Tillers	73	42	25
	100%	100%	100%

TABLE 35. DISTRIBUTION OF BORERS FROM EGGS DEPOSITED JULY 2 - 5.

	Date of dissection		
	7/15	7/25	8/2
Number of borers	43	59	34
Percent of borers found in:			
Ears and ear shoots	23%	22%	17%
Leaf sheaths around ears	2	3	....
Portion of stalk supporting ears	....	9	15
Other portions of main stalk	12	10	9
Tillers	63	56	59
	100%	100%	100%

TABLE 36. DISTRIBUTION OF BORERS FROM EGGS DEPOSITED JULY 6 - 10.

	Date of dissection 7/20	7/29
Number of borers	6	30
Percent of borers found in:		
Ears and ear shoots	50%	27%
Leaf sheaths around ears	....	....
Portion of stalk supporting ears	....	13
Other portions of main stalk	....	20
Tillers	50	40
	100%	100%

In the above, the ears and ear shoots were considered together. An infestation in the ears or ear shoots destined to form marketable ears is of more serious nature than one later in the season in a rudimentary ear which will never reach maturity. In the corn used in this experiment, five ear shoots commonly form, the first one of which regularly develops into a marketable ear, the second one usually does, and the third infrequently does. Inasmuch as the best ear develops from the first ear shoot to appear, it is available for insect attack for a somewhat longer period of time than the other ear shoots. This results in a relatively greater infestation in the potential ears than in the other ear shoots, as can be seen from a consideration of 170 corn plants on each of which were present two potential ears and from none to four additional ear shoots. The infestation of the ears and rudimentary ears is tabulated as follows:

TABLE 37. BORER INFESTATION IN EARS RELATIVE TO NUMBER OF EAR SHOOTS PRESENT.

	Number of plants	Number of borers in two ears or potential ears	Number of borers in all other ear shoots
Plants with:			
Two ears, no ear shoots	46	55	....
Two ears, one ear shoot	87	83	25
Two ears, two ear shoots	27	21	6
Two ears, three ear shoots	6	9	10
Two ears, four ear shoots	4	20	6

Analysis of detailed data clearly shows that, in the early stages of plant growth, the green tassel is the most attractive region of the plant to the borers. Most of the newly hatched larvae immediately seek that structure, in most cases penetrating the pollen buds, there to remain embedded until the third or even fourth larval instar is reached, when the borers migrate downward. Although, as Neiswander (*et al,* l.c.) found, this migration was correlated with the spreading out and yellowing of the tassel, it is not clear whether the stage of plant growth, the stage of insect growth, or the exhaustion of food is responsible for the larval movement.

A point of interest, but one difficult of estimation, is the proportion of the larvae involved in this migration which reach the various regions of the plant. The tillers appear to absorb a large proportion of the migrating larvae. If it is assumed, in those tabulations above in which borer eggs were deposited early in the season, that the increase in borer population in the ears and ear shoots is due entirely to this migration, the figures, as given, represent the proportion for these plant structures. Certainly the chief source of the borers in the ears of plants early infested is from the tassel buds. A certain amount of migration from other plants may account for some of the borers in ears, but it is reasonable to suppose that emigration from one plant compensates for immigration from others. The possibility of a primary infestation of the ears by borers from eggs overlooked in routine examination of plants is minimized by the fact that the detailed data show few larvae younger than the third instar present in the ears.

In plants infested later in the season, when ears are developing on the plants, a marked attraction for the borers is noted in the ear shoots. For the corn under consideration, June 20 dated the beginning of ear shoot development, and it is obvious from the tabulations above that plants infested after this date showed a large primary infestation in the growing ears, and that the attraction of these structures for the borer superceded that of the tassels. That the infestation of ears was primary and not a result of migration is evidenced by the fact that the larvae present at the first dissections after attack were predominantly in the first or second instar.

It may be stated summarily, then, that in the early stages of plant growth, the chief infestation by the corn borer occurs primarily in the tassel and the subsequently developing ears become secondarily infested by the migrant larvae from the tassels. If, however, ear shoots are present at the time the corn borers hatch, they become primarily infested and the tassels no longer are attractive to the young borers.

According to the oviposition trend based on observations of 20 hills of corn in an adjacent plot by the Bureau of Entomology and Plant Quarantine of the U.S.D.A., approximately 30 percent of the corn borer eggs of the first generation presumably hatched before ear shoots were present on the plants. Consequently, borers resulting from these eggs infested the developing ears only secondarily. The bulk of the eggs hatched subsequent to June 20, the ears then being infested directly. The peak of oviposition occurred between June 17 and June 20.

Similar observations on the second generation of corn borer were made on Golden Cross Bantam corn planted about June 25, and on Carmelcross planted on July 2. By the time the borers started feeding, the corn was well developed with ear shoots appearing.

Bearing out the observations on the first generation borer, the corn tassels lost their attraction for the larvae coincident with the development of ear shoots. Because of this, the ears, with minor exceptions, showed a relatively uniform percent infestation throughout the season, suggesting that the infestation was primary. This is seen in the following tabulation, in which only the infestation in the potentially marketable ears is considered:

TABLE 38. SECOND GENERATION BORER INFESTATION IN EARS.

All eggs deposited allowed to hatch.						
Time dissected, in days after first infestation	10 days	15 days	20 days	25 days	30 days	
Total borers present in 10 plants	79	56	84	115	83	
Percent borers in potential ears	11%	5%	19%	10%	11%	
All eggs deposited allowed to hatch.						
Stage of plant at time of dissection	Ear shoot		Silk		Harvest	
Total borers present in 10 plants	90		92		128	
Percent borers in potential ears	0		3%		20%	
Plants infested August 5 - 9						
Date of dissection	8/22	9/5	9/10	9/13	9/16	9/26
Total borers present in plants dissected..	26	89	77	33	65	133
Percent borers in potential ears	12%	10%	10%	15%	12%	9%
Plants infested August 10 - 15						
Date of dissection	9/2	9/5	9/9	9/13	9/17	9/22
Total borers present in plants dissected..	36	27	35	53	76	89
Percent borers in potential ears	11%	44%	34%	38%	12%	26%
Plants infested August 16 - 22						
Date of dissection	9/5	9/13	9/17	9/22	9/26	
Total borers present in plants dissected..	11	25	38	22	51	
Percent borers in potential ears	18%	12%	3%	23%	16%	
Plants infested August 23 - 27						
Date of dissection	9/11	9/26				
Total borers present in plants dissected..	22	40				
Percent borers in potential ears	32%	10%				

The application of the information obtained in this study will depend upon further observations involving the reactions of larvae of different stages to insecticide placed in restricted regions of the plant. But the fact that in 1940 the ears were primarily attractive to first generation larvae, when 70 percent of the borer population was being established, and secondarily attractive when only 30 percent was being established, may explain in part the favorable results in control obtained by Turner[1] in spraying the ears alone, leaving the rest of the plant untreated.

[1]See pp. 358-359.

EUROPEAN CORN BORER INSECTICIDE INVESTIGATIONS

NEELY TURNER

A large-scale experiment in controlling the European corn borer (*Pyrausta nubilalis* Hubn.) by means of dusts was carried out on early market sweet corn. A detailed account of this test has been submitted for publication elsewhere. In brief, it proved both practical and profitable to dust such corn. When dual-fixed nicotine dust (the more effective material) was used, treated corn sold for $343.00 an acre and the cost of treatment was estimated at $42.50. Corn from untreated plots sold at the rate of $100.00 an acre for borer-free corn only, and infested untreated ears could be sold only with difficulty. Grading corn as borer-free and infested was successful because the borer-free ears brought a premium price on the market.

The technical studies of insecticides were made on small plots of sweet corn, in both the first and second generations. The plots for hand application were four rows wide and 25 feet long, and those for machine application were 50 feet long. The design was one of randomized plots in replicated blocks. The sample for results was 20 plants taken at random from the two inside rows of each plot and dissected to determine the number of borers. There were two untreated plots in each block to afford adequate numbers for comparison with treated plots. Hand application of dusts was made with a knapsack bellows duster. For machine application, a power, two-row, self-propelled duster was used. Compressed air hand sprayers were used in the spray tests.

The infestation of corn borers was lower than in previous years. The cool spring weather retarded development somewhat. The early emergence of moths appeared to be normal in numbers. However, exceptionally cool weather late in June prevented a large infestation. The second generation developed more normally but was still fewer in numbers than usual. Rainfall was abundant but did not interfere seriously with the schedules.

First Generation Tests

Two fields were used in these tests. In Field I dual-fixed nicotine dust (the commercial preparation containing not less than 3.75 percent nicotine) and derris dust (commercially prepared, containing

1 percent rotenone) were compared. Both dusts were applied by machine and by hand to wet foliage in the early morning and to dry foliage in late evening. The dates of application were June 11, 16, 21 and 27-28. The evening series of the last treatment was applied June 27 and the morning series on the following day.

A summary of the results is given in Table 39. Statistical analysis of the results showed that hand application was significantly better than machine, and that dual-fixed nicotine dust was more effective than derris dust. The difference between application to wet and dry foliage was suggestive but not statistically significant.

TABLE 39. SUMMARY OF RESULTS — FIELD I.

Treatment	Number larvae in 100 plants	% reduction of borers	% No. 1 ears borer-free
Dual-fixed nicotine dust			
by hand on dry leaves	98	70.7	77.0
by hand on wet leaves	141	58.0	74.6
by machine on dry leaves	134	60.0	58.8
by machine on wet leaves	173	48.4	59.8
Derris dust			
by hand on dry leaves	176	47.6	72.4
by hand on wet leaves	167	50.3	64.6
by machine on dry leaves	184	45.1	57.1
by machine on wet leaves	221	34.2	56.4
No treatment	336	......	37.9

In Field II both dual-fixed nicotine and derris dusts were applied by hand: (1) four applications at intervals of five days (June 13, 18, 25 and 30); and (2) three applications at intervals of seven days (June 13, 21 and 30). Pure ground derris root (4.7 percent rotenone) was used in the same schedules, mixed with the *Ultrawet* spreader at the rate of two ounces to a pound of derris root suspended in 25 gallons of water. Applications of a spray to the ears only were made on June 28, when young ear shoots had formed; July 8, just prior to silking; and July 15, when the ears were in full silk. Two varieties of early corn, Spancross and Marcross, were used, with four blocks of plots in each variety.

TABLE 40. SUMMARY OF RESULTS — FIELD II.

Treatment	Number larvae in 100 plants	% reduction of borers	% No. 1 ears borer-free
Spancross			
Dual-fixed nicotine dust			
4 applications, 5-day interval	66	82.2	76.7
3 applications, 7-day interval	121	67.5	64.4
Derris dust			
4 applications, 5-day interval	141	62.2	57.9
3 applications, 7-day interval	188	49.8	60.6
Derris spray			
4 applications, 5-day interval	110	70.9	64.5
3 applications, 7-day interval	196	47.5	48.5
3 applications, ears only	......	......	64.2
No treatment'	374	......	38.6
Marcross			
Dual-fixed nicotine dust			
4 applications, 5-day interval	129	71.3	66.7
3 applications, 7-day interval	117	73.8	62.7
Derris dust			
4 applications, 5-day interval	169	62.4	52.1
3 applications, 7-day interval	303	32.3	30.0
Derris spray			
4 applications, 5-day interval	221	50.7	42.9
3 applications, 7-day interval	120	73.2	67.6
3 applications, ears only	......	......	59.7
No treatment	449	......	37.7

A summary of the results is given in Table 40. Statistical analysis of the combined results from the two varieties showed that in the dust tests four treatments at intervals of five days were more effective than three applications at intervals of seven days. In the spray test, the reversal of results on Spancross and Marcross was unexpected and inconclusive. The application of spray to ears only was surprisingly effective.

Second Generation Tests

In these tests dual-fixed nicotine dust was applied by hand in comparison with the machine, and to wet and dry foliage on a standard schedule of five applications at intervals of five days (August 12, 17, 22, 27 and September 2). Hand applications were also made at intervals of seven days on wet and dry foliage (August 12, 19, 26 and September 1). In addition two materials were tested by hand applications on dry foliage on the five-day schedule: (1) a dust made of 2.5 pounds *Agicide Concentrate* and 7.5 pounds pyrophyllite (approximately .15 percent rotenone and .5 total extractives); and (2) a commercially prepared dust of *Dry Pyrocide* labelled *No. 10* (.2 percent pyrethrins).

The results are summarized in Table 41. Machine applications were significantly better than hand, and application to wet foliage gave better (but not statistically significant) results than to dry. Four applications at intervals of seven days were as effective as five applications at intervals of five days. Derris, *Dry Pyrocide* and Agicide dusts were significantly less effective than dual-fixed nicotine dust.

TABLE 41. SUMMARY OF RESULTS — SECOND GENERATION.

Treatment	Number larvae in 100 plants	% reduction of borers	% No. 1 ears borer-free
Dual-fixed nicotine dust			
5-day schedules			
by machine on dry leaves	175	78.8	78.4
by machine on wet leaves	105	87.3	84.0
by hand on dry leaves	217	73.7	74.4
by hand on wet leaves	217	73.7	74.9
7-day schedules			
by hand on dry leaves	205	75.2	78.0
by hand on wet leaves	187	77.3	77.7
By hand on dry leaves — 5-day schedules			
Derris dust	337	59.3	64.3
Dry Pyrocide dust	404	51.2	53.7
Agicide dust	428	48.2	55.8
No treatment	828	......	37.6

Discussion. The most consistent difference was that between dual-fixed nicotine and derris dusts, which was uniform in all tests. In the first generation there were definite indications that the standard four applications at intervals of five days were more effective than three applications at intervals of seven days. No such difference occurred in the second generation tests. The results regarding application to wet and dry foliage are somewhat in conflict, but at least it can be concluded that evening applications may be as satisfactory as those made early in the morning.

The more effective use of the machine as compared with the hand duster in the second generation might well be due to better operation and adjustment of outlets. The first generation tests were made with the new machine of a type which had not been available previously.

One very encouraging result was the comparatively high effectiveness of the spray applied to ears only. This will be investigated further since it offers a less expensive treatment than the standard applications of sprays or dusts.

CONTROL OF THE CABBAGE MAGGOT

NEELY TURNER

The cabbage maggot (*Hylemyia brassicae* Bouché) is by far the most destructive insect pest of early cabbages, cauliflower and related crops in Connecticut. In some seasons few maggots appear, but as a general rule enough are present to justify treatment every year. The development of the bichloride of mercury treatment has enabled growers to control the cabbage maggot successfully. However, this material is difficult to dissolve and handle in the field, because only wooden, glass or enameled containers can be used to handle the solution. Furthermore, the solution injures roots of young or newly-set plants (Glasgow, 1929). The search for other effective materials resulted in the discovery by Glasgow that calomel (monochloride of mercury) is a satisfactory chemical. Furthermore, calomel has been used successfully in dust form, which eliminates the necessity of handling quantities of water.

The standard practice has been to apply a dust containing 4 percent calomel diluted with 96 percent talc, clay, or gypsum around the stem of the plant two or three times during the egg-laying period in May. This appears to be a simple control measure, but many growers have not obtained satisfactory results. Application too late to protect the plants has been the most common failure, with use of a much too small amount of dust of almost equal importance.

Glasgow also demonstrated that pure calomel applied to the stems of plants before setting is effective, providing the coating is not destroyed during the planting operation. In actual practice the coating of calomel is usually broken or destroyed during planting. For this reason a series of tests was started, using other methods of application.

In 1938 the roots of plants ready for setting in the field were dipped in calomel dust just before planting. For comparison, a teaspoonful of calomel dust was placed around the stems of the plants immediately after setting. Both treatments were effective, and the application of dust around the stem after setting seemed to be more practical from the growers' standpoint. In 1939 this method was compared in a preliminary test with the standard treatment of two applications of dust around the stem of the plants during the oviposition period in May. The planting time application was made by hand and the May treatments by a small hand duster of a type used commonly by growers. The treatment at planting time was more effective in controlling cabbage maggots than the surface applications.

In 1940 the tests were made on a larger scale in randomized plots. The treatments were applied to Copenhagen Market cabbage, set April 25, as follows:

1. Four percent calomel mixed with 96 percent Bancroft clay, applied by hand to the surface of the ground around the stem of each plant immediately after setting. Material was used at the rate of 106 pounds to the acre.

2. A similar treatment using 8 percent calomel, at the rate of 96 pounds to the acre.

3. Surface treatments on May 14 and 24, using 4 percent calomel dust applied by a small hand duster. The total amount of dust used in both applications was 66 pounds.

4. No treatment.

Each treatment was applied to six plots and a plot consisted of two rows of 10 plants each. The heads were harvested as they matured, and records kept of the weight per row. A summary of the results is given in Table 42. Analysis of variance of the original figures on which the summary is based showed highly significant differences between treated and untreated in regard to number of heads and total yield, and no difference between number of heads and yield among the three treatments.

TABLE 42. YIELD OF CABBAGE AND MAGGOT TREATMENT.

Treatment	Number heads	Total weight (lbs.)	Average weight per head (lbs.)
4% calomel — planting time	115	302.31	2.63
8% calomel — planting time	115	325.44	2.83
5% calomel — May treatment	112	312.06	2.79
No treatment	81	196.12	2.42

Discussion. The amount of calomel per acre applied by surface application was slightly more than half that used in planting time treatments. There is no information in this experiment to indicate the minimum amount of calomel necessary to protect the plants. The facts that surface treatment with a smaller amount of material was effective, and that increasing the amount of calomel from 4 percent to 8 percent was unnecessary, indicate that the planting time dosage might be reduced. Regardless of this point it is evident that surface treatments at planting time were effective. The planting time treatment is highly advantageous to the grower. It avoids the always difficult task of timing May applications during the oviposition dates of the maggot flies. It enables the grower to complete planting and treatment in one operation. When the plants are small it is much less trouble to apply the dust around the stems than when they have grown larger. Furthermore, the month of May is perhaps the busiest of the year for the average vegetable grower, and transfer of the treating date for cabbage to April should be a distinct advantage.

Summary. The two preliminary tests followed by a larger scale plot test have demonstrated that an application of 4 percent calomel dust around the stems of newly-set cabbage plants is a satisfactory treatment. Such an application is as effective as the standard treatments usually applied in May.

Literature Cited

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SEASONAL DEVELOPMENT OF THE JAPANESE BEETLE AND SPRAYING FOR THE ADULT INSECT

J. Peter Johnson

Several lots of immature stages of the Japanese beetle were obtained from diggings made in Bridgeport and New Haven during the month of June, 1940. The majority of the insects were in the third larval instar, but prepupae and pupae also were present. The results of the diggings are given below.

Table 43. Results of Spring Diggings, 1940.

Location	Date	3rd Instar Larvae	Prepupae	Pupae	Total
East Rock Park, North End, New Haven	June 12	46	21	4	71
East Rock Park, Rice Field, New Haven	June 19	29	24	6	59
Municipal Golf Course, New Haven	June 19	18	18	34	70
Seaside Park, Bridgeport	June 19	66	14	4	84

The most advanced stages were found at the Municipal Golf Course, and the place where the diggings were made was in a protected area having a southern exposure. None of the pupae were in the advanced stage.

The adult beetles began to emerge from the soil approximately two weeks later than usual in the summer of 1940. This was probably due to adverse temperature and moisture conditions earlier in the season. April had a mean temperature (Hamden) of 3° F. below normal and the precipitation was about normal. The mean temperature for May was 1° F. below normal while the precipitation was about three times normal. During June the mean temperature was 1° F. below normal and the precipitation was about normal. However, the coolest period during this last month occurred between June 20 and June 27 at the time when the adult beetles usually emerge from the soil. During this period the daily mean temperature rose above 59° F. only twice and on one of these days it was 63° while three days later it was 61°.

The first beetle reported in the vicinity of New Haven was found on July 6. For the next few days the beetles observed were few in number but on and after July 11 they were becoming more abundant. The beetles were abundant in old areas of infestation and continued to cause defoliation until about the first week in September. However, in localized areas beetles were numerous until October, feeding on low growing plants. The last adults were observed in the field on October 15. Freezing temperatures occurred for the next several nights and no further observations were made.

As the beetles were late in emerging, the experimental spray program was delayed accordingly. The areas selected for spraying were situated in an urban section where many favorite host plants were growing and beetle feeding had been general the preceding season. One-half of a city block was selected as a unit for each spray, and all host plants, together with other non-attractive plants which were incidental in the group plantings, were sprayed.

1. Lead arsenate at the rate of 6 pounds, plus 4 pounds of wheat flour and 1 quart of soybean oil to 100 gallons of water was applied July 11 to the first unit. Among the host plants sprayed were sweet cherry, sassafras, Norway maple, Virginia creeper, linden and white birch. Heavy showers occurred only a few hours after the spray was applied, and heavy rains continued throughout the night and the next morning. Altogether 2.16 inches of rain fell within the 24 hours following the application.

2. The second unit was sprayed on July 13 with a mixture composed of 4 pounds of lead arsenate, 4 pounds of wheat flour, and 1 quart of soybean oil to 100 gallons of water. Sweet cherry, Chinese elm, white birch and mountain ash were among the host plants treated.

3. The third unit was sprayed on July 15 with a mixture of lead arsenate 4 pounds, wheat flour 4 pounds, water 100 gallons. Among the host plants treated were weeping willow, apple, Norway maple, Japanese red maple, althea and purple leaf plum.

4. The fourth unit was sprayed six times at intervals of seven days with pure ground derris root (containing 4 percent rotenone) at the rate of 6 pounds, plus 1 quart of rosin residue emulsion, to 100 gallons of water. The beetles were present in numbers sufficient to cause defoliation for a period of approximately six weeks. It was observed that the beetles would return in numbers to the most favored host plants, such as Chinese elm, roses and Virginia creeper, by the sixth and seventh day after each spray, and cause slight

additional damage. This would indicate that if it were desirable to obtain the best results with the derris spray, it would be necessary to make an application every fifth or sixth day, depending upon the degree of beetle infestation. A single application of the derris spray leaves very little visible residue, but as only 1.35 inches of rain fell (Hamden) during the period, the accumulated residue from the six applications was very noticeable.

The units sprayed with the lead arsenate, flour, and soybean oil, and with the lead arsenate and flour mixture were adequately protected and no appreciable damage occurred to treated foliage. Unsprayed new growth was attacked and eaten on some of the primary host plants but this was not general. A few trees left unsprayed as checks were partially defoliated and the beetles attacked the fruit on unsprayed peach trees located on one of the properties. Due to the small amount of rainfall only one spray of these materials was applied. It would be necessary in seasons of heavy rainfall, when the spray was washed off the foliage, to make one or two additional applications.

A number of trees, namely sassafras and mountain ash, in East Rock Park, New Haven, were sprayed July 15 with tetramethyl thiuram disulfide at the rate of 2 pounds, plus 2 pounds of phenothiazine, to 100 gallons of water. The sprayed sassafras foliage was definitely protected for a period of approximately two weeks. A small number of beetles then reinfested the foliage and the accumulative light feeding was apparent by the end of August. The unsprayed new growth on most of the sassafras trees was attacked as soon as it developed. The mountain ash foliage was reinfested within a few days after being sprayed and some defoliation occurred before the end of the season. There was a total of 2.19 inches of rainfall (Hamden) from July 16 until September 10. Small amounts of rain fell on 17 different days, 0.66 inches being the largest amount on any one day.

Observations were made in a commercial vineyard in Greenwich, where two applications of tetramethyl thiuram disulfide and phenothiazine were made approximately two weeks apart on one variety, the Delaware grape, which is very susceptible to Japanese beetle attack. The first application was made in the first week of July when the first adults were expected to emerge, and the second one was applied on July 16 when the insects were becoming very numerous. On July 18 many beetles were observed throughout the area in which the vineyards were located. The sprayed vines were comparatively free of infestation as only one beetle was observed on them. However, as the season progressed, the beetles returned and ate all of the new foliage and some of the older sprayed foliage. Sufficient of the older foliage remained to enable the fruit to mature, whereas in the preceding year it was reported that the vines were defoliated to such an extent that the grapes failed to develop properly.

Beetles were more numerous than in preceding seasons, and defoliation occurred over larger areas. These conditions were very noticeable in Branford, Bridgeport, East Hartford, Greenwich, Hamden, Hartford, New Haven and West Hartford. Nectarine and plum trees were defoliated in one orchard in Greenwich. Ripening peaches were eaten by the beetles in the same orchard, resulting in a considerable loss to the grower. The derris and rosin residue emulsion mixture, used at the same rate as given above, was applied to a number of the trees attacked and protected the foliage and fruit for a period of five to six days.

Below is a list of ornamental trees and shrubs sprayed during the season of 1940 with lead arsenate at 6 pounds, wheat flour 4 pounds, and soybean oil 1 quart to 100 gallons of water.

Azalea amoena	*Rhododendron obtusum* var. *amoenum*
Bush honeysuckle	*Lonicera* sp.
Shrub-althea	*Hibiscus syriacus* (pink and white)
American linden	*Tilia americana*
Butterfly bush	*Buddleia magnifica*
Dogwood, Flowering	*Cornus florida*
Dogwood, Red flowering	*Cornus florida rubra*
Dogwood, Red osier	*Cornus stolonifera*
Deutzia, Slender	*Deutzia gracilis*
Birch, Gray	*Betula populifolia*
Birch, European white	*Betula alba*
Birch, Sweet	*Betula lenta*
Cherry, Sweet	*Prunus avium* var.
Crab, Flowering (white)	*Malus* var.
Crab, Flowering (pink)	*Malus* var.
Apple, McIntosh	*Malus sylvestris* sp.
Coralberry	*Symphoricarpos vulgaris*
Forsythia, Border	*Forsythia intermedia*
Forsythia, Weeping	*Forsythia suspensa*
Kerria	*Kerria japonica*
Hugonis rose	*Rosa hugonis*
Hawthorn, White	*Crataegus* var.
Elm, American	*Ulmus americana*
Elm, Chinese	*Ulmus parvifolia*
Elm, Dwarf Asiatic	*Ulmus pumila*
Apple, var.	*Malus sylvestris* sp.
Hydrangea, Peegee	*Hydrangea paniculata grandiflora*
Maple, Norway	*Acer platanoides*
Maple, Japanese red	*Acer palmatum rubrum*
Maple, Schwedler's	*Acer platanoides schwedleri*
Maple, Silver	*Acer dasycarpum*
Maple, Sugar	*Acer saccharum*
Lilac, Hort. var.	*Syringa* var.
Lilac, White	*Syringa persica alba*
Mockorange, Big	*Philadelphus coronarius grandiflora*
Mockorange, Sweet	*Philadelphus coronarius*
Japanese barberry	*Berberis thunbergi*
European mountain ash	*Sorbus aucuparia*
Purpleleaf plum	*Prunus cerasifera pissardi*
Siberian pea tree	*Caragana arborescens*
Silverberry	*Elaeagnus argenta*
Spirea, Anthony Waterer	*Spirea Anthony Waterer*
Spirea, Vanhoutte	*Spirea vanhouttei*
Snowberry	*Symphoricarpus racemosa*
French tamarix	*Tamarix gallica*

Tuliptree	*Liriodendron tulipifera*
Weigela, Red flowering	*Weigela Eva Rathke*
Weigela, Pink	*Weigela rosea*
Willow, Weeping	*Salix babylonica*
Willow, Laurel	*Salix pentandra*
Winged euonymus	*Euonymus alatus*
Rugosa rose	*Rosa rugosa*
Flowering quince	*Cydonia japonica*
Lancaster heart nut	*Juglans sieboldiana*
Sassafras, Common	*Sassafras variifolium*

The trees and shrubs are listed according to "Standard Plant Names".

THE BLACK VINE WEEVIL AND ITS CONTROL

J. Peter Johnson

The first record of the occurrence of the black vine weevil, *Brachyrhinus sulcatus* Fabr., in Connecticut is that of an adult, now in the Station collection, found in New Canaan on September 19, 1910. During that year, a few other specimens also were found in New Haven and one in Litchfield. Taxus plants were injured so severely in Pomfret, in 1913, that many of them died. The injury was caused by the weevil larvae feeding upon and cutting off the roots. Occasional specimens of the insect were collected during the next few years. Since 1927 there are records of the weevils occurring annually, being found in nurseries and greenhouses or sent in for identification. In 1939 they were found in five nurseries. However, in 1940, due to an intensive inspection of all commercial Taxus plantings, weevils were found in 19 nurseries. As the insect appears to be increasing in abundance and as it is capable of doing considerable damage in localized areas, a study of its habits and methods of control was inaugurated. Reports have been made by other workers on the use of lead arsenate as a spray, baits containing sodium fluosilicate or calcium arsenate for the control of the adults, and lead arsenate as a soil insecticide for the control of the larvae, as well as on the life history of this insect. Smith's (2) report on the use of lead arsenate in potting soil is about the most extensive one concerning the use of this poison as a soil insecticide for the control of the larvae. Gambrell (1) has reported on the use of various baits, sprays and soil treatments for the control of the strawberry root weevil, *Brachyrhinus ovatus* (L.), a closely related species, which is often associated with the black vine weevil about the roots of Taxus.

Fifteen diggings were made on May 27, 1940, in a block of *Taxus cuspidata capitata,* which was heavily infested, removing entire plants. There were a few spreading hemlocks and *Taxus baccata repandans* growing adjacent to the block of *T. capitata,* and one each of these plants was dug for examination. In each case the entire plant was removed and the soil excavated to include all of the root system. The results of these diggings are given in Table 44.

TABLE 44. SEASONAL DEVELOPMENT, MAY 27, 1940.

Tree	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total	Percent
Larvae	9	33	34	2	8	7	4	18	2	7	1	0	7	20	3	37	47	239	60.66
Pupae	7	7	11	2	16	6	9	12	3	1	0	0	0	4	4	17	51	150	38.07
Adults[1]	0	0	0	0	0	0	0	1	0	0	0	0	4	0	0	0	0	5	1.27
Total	16	40	45	4	24	13	13	31	5	8	1	0	11	24	7	54	98	394	

[1]Collected during examination of debris under trees prior to digging.

All of the pupae collected in these diggings were white in color and not one was in an advanced stage of development. A few of the larvae were small but most of them were fully grown or pre-pupae. The adults found were dissected in a few days and some of them contained eggs. As the spring season was cool and late, conditions were not conducive for early transformation from larvae to adults. The adults collected on May 27 were not fresh and clean in appearance, and as they were ready to deposit eggs, it is evident that they had hibernated successfully. The hibernation of adults has been reported from Pennsylvania and Oregon. Apparently only a small number are successful in passing the winter, as the above figures indicate and as verified by the reports of other workers.

Adult emergence from the soil was well under way by June 20. A number of observations were made during the season to note their habits. On June 28, the debris in the crotches of the trees was examined. There was a considerable amount in one tree, and upon removing about one-third of it, 20 live adults were found. Adults also were found in a similar situation in several of the other trees. Evidently the insects prefer to hide during the daytime in locations which do not remain damp and wet and will take shelter above the ground in the leaves and debris in the crotches of the trees. Most of the adults are found in the leaves and debris on the ground immediately around and close to the trunks. On July 5, 32 adults were found under one tree, and 22 of these were under a loose clump of soil against the base. A number were found in the cracks of the soil against the trunks. Five adults were found on September 28 in debris in two different trees and one adult in the debris under a third tree. Upon being disturbed in the daytime, the adults will play possum and remain immobile for some time. If exposed to light, they will soon try to gain shelter in debris or under loose clumps of soil.

The adults feed upon the leaves of Taxus, chewing notches in the edges. Feeding has been observed between 6 and 7 feet above the ground on large, upright trees, but most of it is lower. Apparently a considerable amount of feeding takes place at first on the small inner branches, close to or on the trunk or main stem. If there are great numbers of adults present, feeding will be very general on all parts of the plant.

The larvae feed upon the roots of the trees. When they are small, they eat the finer roots, and as they approach full growth attack the larger roots and oftentimes partially girdle the trees just below the crown. Heavy feeding on the finer roots causes the foliage to acquire a yellowish, unhealthy color, while severe root damage will cause leaf drop and the tree will become shabby in appearance. Severe root feeding kills the trees.

A series of experiments on the control of this weevil was started during the season of 1940 to investigate the value of lead arsenate as a spray, lead arsenate as a soil insecticide, a commercial bait consisting of dried apple flakes and sodium fluosilicate, and bran baits containing sodium fluosilicate or calcium arsenate. Lead arsenate at the rate of 5 pounds to 100 gallons of water was used as a spray on the foliage of *Taxus cuspidata* and *T. cuspidata capitata.* As the weevils are apt to feed on any or all parts of the foliage and especially that near the trunk, it is necessary to spray thoroughly to cover those portions of the plant subject to attack. Lead arsenate was used at the rate of 3 pounds to 100 square feet as a soil poison. This was applied to the surface of the soil under the plants over an area slightly larger than the diameter of the entire tree and then mixed with the upper two inches of soil. The baits were applied at the rate of about one cupful per tree, distributed evenly. Most of the trees treated were 24 to 36 inches in height, but there were a few 5 to 7 feet high. The amount of bait placed under the larger trees was increased so that the areas under the plants were adequately treated.

The baits and lead arsenate soil treatment were applied on June 20, while the lead arsenate spray was applied on June 21, as the adults were then appearing in considerable numbers. Much rain fell and the humidity was high during the next few days, and the baits became moldy. Fresh bait was applied on June 28. Again the material became moldy and one-half of the plots received another application on July 15. The bran baits deteriorated more rapidly than the commercial bait containing the dried apple flakes. Only one application of the sprays was necessary during the season as the residue persisted throughout the summer months.

The treatments were replicated four times in blocks containing from 15 to 25 trees each. Five trees were dug in each block to obtain a count of all larvae present. All the soil was removed from the roots of each plant and every digging included the entire root system. The diggings were made on September 26, 27, 30, and October 1 and 4. The results indicated that the baits containing sodium fluosilicate and the lead arsenate spray were more promising than either the bait containing calcium arsenate or the soil treatment with lead arsenate. However, all of the treatments were of merit, but further work is necessary before conclusive comparisons may be drawn.

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NOTES ON THE CONTROL OF MOUND-BUILDING ANTS

J. Peter Johnson and R. B. Friend

During the summer of 1940 many active nests of the moun-building ant, *Formica exsectoides* Forel., were reported in a pine plantation of the Eli Whitney Forest, in the town of Prospect. In one section of the plantation 17 mounds were situated between the pine stand and a main road and in a barway leading into the pines. They were located in areas exposed to sunlight during most of the daylight hours. The nests varied in size, the smallest being 8 inches in height and 18 inches in diameter, while the largest was 12 inches in height, 8 feet in width and 12 feet in length. The latter nest was a composite of five nests which had become contiguous. All of the mounds were very active, evidently inhabited by strong colonies. In another part of the plantation new colonies in small nests were injuring and killing young plantings of pine.

The presence of these nests afforded an opportunity to check several methods of control. Eight of the mounds were treated and the results are given in Table 45.

The treatments were made on August 2 when the soil temperature at a depth of 3.5 inches was 72° Fahrenheit. The carbon bisulfide in each case was applied in equal amounts in five holes in mounds 4 and 5. Each hole was closed immediately after the insecticide was applied. Equal amounts of methyl bromide were placed in each of five holes in mound 1, while mound 2 received the fumigant in seven holes. The top 4 inches of mound 3 was removed, the methyl bromide was poured as evenly as possible over the exposed surface, and the removed material was replaced immediately. Mound 6 was treated with pure ground derris root (containing at least 4 percent rotenone). This was broadcast by hand in a band about 12 inches wide, completely encircling the mound. Freshly cut pine boughs were placed over mounds 7 and 8 to form a blanket 12 to 18 inches in depth.

Approximately six weeks after the treatments were made, the three mounds treated with varying amounts of methyl bromide were inactive and the ants dead. One mound that had been treated with carbon bisulfide was very active, while in the other the ants were dead. The large colony treated with the pure ground derris root was all but exterminated, with only a few living ants in one end of the mound and thousands of dead ants present in a band encircling the mound. Many dead ants were also found in the galleries near the exits. In both cases where the pine boughs were used to cover mounds 7 and 8, the nests were built up through the boughs so as to be exposed to the sunlight. Mound 7 had also been increased in size so as to extend beyond the periphery of the boughs.

TABLE 45. TREATMENTS OF ANT COLONIES AND RESULTS.

Mound No.	Size of Mound		Treatment		Results	
	Height	Diameter	August 2	Amount	August 12	September 13
1	10″	24″	Methyl bromide	250 cc.	Very few ants alive	Dead colony
2	10″	24″	" "	390 cc.	Inactive	" "
3	11″	48″	" "	520 cc.	Inactive	" "
4	10″	30″	Carbon bisulfide	550 cc.	Some activity	Very active
5	6″	4′ x 3′	" "	550 cc.	Inactive	Dead colony
6	10″	12′ x 6′	Derris (4% rotenone)	1 pound	Thousands of dead ants on surface	Very little activity
7	24″	5′	Pine boughs	Covered	New mound begun at edge of boughs	Through top of boughs and around edges
8	16″	4′	" "	"	Activity all around	Built up through top of boughs
9-17			All other mounds not treated		All very active	All very active

These experiments were conducted not only to check existing recommendations but to try new insecticides and, if possible, to find a simple method of control which was not laborious and which could be adapted to rough terrain. A certain amount of equipment is necessary to inject or apply methyl bromide or carbon bisulfide successfully, and under forest conditions it is rather difficult for a man to transport. Covering the mounds with pine boughs is an easy method, but as it is known that ants will either overcome such a handicap or migrate from an unfavorable location, as again demonstrated by this experiment, the success of this method is doubtful. In view of the size of mound 6, the possibility of re-entry of ants, the high degree of control, and the simplicity of the method justify giving derris root a further trial.

Methyl bromide is apparently more efficient than carbon bisulfide in controlling the ants but its application is difficult. Carbon bisulfide presents a possible fire hazard in the quantities necessary, while the toxic danger of methyl bromide to man is reduced to a minimum when used in the open air. Derris root does not present these hazards and is non-toxic to man. However, derris root is toxic to cold-blooded animals and it would be necessary to exercise care when using it in the vicinity of waters containing fish. As its toxic properties are destroyed by sunlight in a week or so, the problems concerning the use of derris root can be overcome easily by discretion in making the applications.

CONTROL OF THE HAIRY CHINCH BUG

Blissus hirtus Montandon

J. Peter Johnson

It has been customary in the past to base control recommendations to prevent lawn injury by the hairy chinch bug on calendar dates, but this has been definitely eliminated because of the influence of seasonal conditions upon the development of the various stages of the insect. Egg deposition apparently extends over a month or more under favorable conditions, but may be lengthened by cool and adverse weather. Unfavorable weather may prolong the period of egg incubation, resulting in a delay of the peak hatch of the insect. There is considerable overlapping of the various stages of the chinch bug, as it is possible to find all stages of the first generation together, and the earlier stages of the second generation appear before the first generation completes its cycle of transformations.

In the spring of 1939, in New Haven, the peak of the first generation nymphs occurred very early in June, and control experiments were started on June 10. However, in the spring of 1940, the first nymphs of the first generation were not found until June 13, and the peak occurred in early July, three to four weeks later than the previous year. The peak of the second generation nymphs usually occurs in August, but in 1938 it occurred in early September.

Control of the Hairy Chinch Bug

It has been noted that practically all of the lawns which have been damaged by the chinch bug contained bent grasses in varying proportions. MacLeod and Maxwell (1) have shown that bent grasses are more susceptible to attack than other grasses. Their more general use over the past 15 years possibly has been responsible for the increase in number of lawns damaged. These grasses are succulent in growth, forming heavy, dense lawns. After a few years the grass clippings, debris and root growth usually form a spongy, dense mat in which the chinch bug can hide and be free from observation until damage from feeding occurs. When a lawn is composed of a heavy, thick grass or is spongy in texture, it is very difficult to apply insecticides satisfactorily. If a nicotine sulfate-soap spray is applied to such turf, sufficient material must be used to penetrate to the surface of the soil to insure the wetting of all the bugs. Dusts applied by hand or by a hand fertilizer distributing machine will not satisfactorily pass through dense grass into the spongy mass found in many lawns, and if the air temperature is below that at which the chinch bugs are active, results will be poor. The insects usually are active when the temperature is around 70° F. and very active at 85° F., or above.

Experiments have been conducted during the past two years with tobacco dusts containing .5 percent and 1 percent nicotine (1), and cubé or derris dusts containing .5 percent and 1 percent rotenone, used at the rate of 25 pounds to 1,000 square feet of lawn area. The tobacco dusts containing .5 percent nicotine gave poor results and will not be used in further work. Good kills were obtained when the other dusts were applied during a period of continuous high temperature and no rainfall. An excellent kill was obtained in the past summer when the materials were applied on a clear day when the mean temperature was 92° F. On one occasion when an extensive series of experimental plots had been treated, and heavy rains followed within a few hours, the rate of kill was so small that the results were worthless.

Results have indicated that the population of a heavy infestation in a dense turf cannot be reduced sufficiently with one treatment of dust to eliminate further damage by the survivors or their progeny. Under such conditions it is usually necessary to make a second application or to spot-treat local areas. Good results have been obtained when the treatment was made under favorable weather conditions in light turf where there was very little debris. Chinch bug populations occur as dense as 1,000 or more to one square foot and to obtain good results the insecticide used must not only be efficient but must be applied under the most favorable conditions.

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CHEMICAL REPELLENTS TO BARK BEETLE BREEDING

Philip Wallace

Tests of various chemicals applied to logs to determine their effectiveness in preventing elm bark beetle breeding were carried out during 1940.

On July 17 five elms were cut and divided into 5-foot lengths. Five racks were made of seven logs each, taken at random from the five trees and placed on 9-inch sleepers. The location was a clearing in the forest where only slight shade was afforded by brush and weeds, and certain tall trees reduced the direct sunlight by about 25 percent. The sleepers of the racks were infested with both *Hylurgopinus rufipes* and *Scolytus multistriatus*, and a heavy emergence also occurred from nearby down trees and cut wood. The racks were placed 10 feet apart and none were more than 30 feet distant from the emerging beetles.

1. Creosote — a liquid coal tar creosote obtained as a by-product in illuminating gas manufacture. This was brushed on the logs, as it would leave an undesirable residue in a sprayer. Certain logs in this rack were left untreated and others were treated only on the upper side.

2. Borax — sodium borate, 3 percent dilution by weight in water, applied with hand pressure sprayer.

3. Phinotas oil — proprietary compound, miscible in water, and having a strong carbolic acid odor. Applied with hand pressure sprayer, 2 percent dilution by volume with water.

4. Hycol — a miscible fraction of coal tar creosote recommended by the manufacturer as a disinfectant and insecticide. Applied with sprayer, 2 percent dilution by volume with water.

Approximately one gallon of each solution was required to spray thoroughly the average bark area of 40 square feet in each rack. The time for filling the tank, spraying, rolling logs, and rinsing the tank was seven minutes per rack.

Table 46 is a summary of the data obtained when the logs were barked and examined in October.

TABLE 46. ELM LOG TREATMENTS.

Treatment	Av. inches diam.	Total sq. ft. bark area	Total *S. multistriatus* galleries	Per sq. ft. *S. multistriatus*
Creosote — "none"	5.0	19.63	24	1.22
Creosote — top-half	3.75	9.82	2	.204
Creosote — entire surface	5.07	10.14	0	0
Borax	4.83	34.71	235	6.77
Phinotas — 2%	5.07	46.46	45	.97
Hycol —2 %	5.55	36.32	45	1.24
Control	4.16	27.15	168	6.19
Total	143.25	184.23	519	
Average	4.74			2.82

Conclusion

Borax was entirely ineffective in preventing elm bark beetle attack. A significant reduction in brood galleries resulted from treatment with both miscible creosote oils but they cannot be considered satisfactory repellents. Liquid coal tar creosote applied to the top of logs in a rack gave good protection, but the untreated placed among the creosoted logs were not satisfactorily protected. Elm logs which received a complete cover of liquid coal tar creosote were entirely free from attack by any bark or wood boring insect.

NOTES ON THE EUROPEAN EARWIG FOR 1940

J. PETER JOHNSON

Through the cooperation of the United States Department of Agriculture, 86 government earwig traps were loaned to the Experiment Station. These traps were placed in favorable locations 4 feet or more above the ground, in and around the area of known infestation. They were suspended on the northerly side of apple, cherry, peach, pear or birch trees, clothes poles, posts or fences on or near lawns, flower gardens or weedy areas.

The section in which the traps were placed included that part of Westville, New Haven, bounded by Alden Avenue and Harrison Street on the east; West Elm Street on the south; Forest Road, Vista Terrace and Pardee Place on the west; Fairfield Avenue and Whalley Avenue on the north; covering an area of more than 10 city blocks. The traps were visited on August 24 when 689 earwigs were taken and on September 18 when 623 were removed.

Earwigs were found on the west side of Alden Avenue, both sides of McKinley Avenue, both sides of Barnett Street, on the north side of Willard Street, and on the south side of Fountain Street. The area of infestation, as indicated by the trap captures, was confined to city blocks bounded by Alden Avenue, West Elm Street, Forest Road and Fountain Street.

An effective control for the young earwig nymphs, as recommended in U. S. D. A. Bulletin No. **566**, consists of a bait prepared in the following proportions: stale white bread 1 pound, Paris green 1 ounce, water to moisten. The bread should be ground up into fine pieces and the Paris green mixed with it while dry. Add water slowly while stirring to make a mixture which will run through the fingers. As the insect is nocturnal in habit, the bait should be broadcast immediately after dusk in gardens and on lawns near vines and shrubs. It should be thrown with sufficient force to break it into smaller pieces. If the infestation is heavy, three applications may be necessary within a period of 10 days. This bait should be applied between May 15 and June 15 on warm nights. Songbirds are more interested in earthworms during this period and danger to them is very slight. A severe decrease in earthworms, due to drought, would possibly increase this danger. Caution should be exercised in exposing domesticated animals and chickens to the bait.

MISCELLANEOUS NOTES

An infestation of a European sawfly, *Gilpinia frutetorum* L., has been found in a red pine plantation in Litchfield, according to J. V. Schaffner, Jr., of the Federal Bureau of Entomology and Plant Quarantine. The larvae were first discovered September 1, 1938, but were rare at that time. In June of the following year a few cocoons were found in the litter on the ground and on the twigs of the trees. On August 1, 1940, over 500 larvae were collected in less than an hour by beating small branches. The infestation appears to be increasing in intensity.

This insect has been known to occur in the United States only during the last few years. The specimens collected in New Jersey July 11, 1938, were the first to be identified in this country, although specimens found in New York State in 1931, but not then identified, were apparently this species. The insect is known to occur in Massachusetts and New Hampshire and in Ontario, Canada. It may become an important pest of red pine.

The writer is indebted to Mr. Schaffner for much of the above information.

[R. B. FRIEND]

Calomycterus setarius Roelofs, a Japanese weevil, has been present in Connecticut at least since 1932, when it was found in the Town of Salisbury. At the present time it is known to occur in the following towns: Fairfield, Farmington, Greenwich. New Canaan, Salisbury, Sharon, Stratford, West Hartford, and Westport. The Stratford infestation, as far as we know, embraces the greatest area, about one square mile. The intensity of this infestation has not increased during the last two years. The other infestations are smaller, being confined to a few acres or less.

This insect has not become an economic pest. In the adult stage it feeds on a number of plants, but appears to prefer legumes. For this reason it was at first considered a potential pest of clover and alfalfa, but it has caused no real damage to either of these crops to date. At the present time, because of its habit of crawling into houses, it is more of a nuisance than an economic pest.

[M. P. ZAPPE]

Nearly every year we have several complaints of clover mites (*Bryobia praetiosa* Koch) entering buildings and annoying the occupants. This year was no exception. A factory office building in Hartford became infested in the early part of March while snow was still on the ground. The building faced the south and near it the snow had melted and grass had begun to grow. The vegetation close to the building, as well as the sides of the building, was literally covered with clover mites. The basement floor was about four feet below the grade level and was used for offices. The clover mites were entering the basement through the large windows and were crawling over the inside walls, desks, etc. Recommendations were to dust sulfur on the outdoor window sills and vegetation, which apparently eliminated the nuisance as no further complaints were received.

[M. P. ZAPPE]

During the month of August two cases of homes infested with the house cricket, *Gryllus domesticus*, were reported. The first one was from Huntington, in the Town of Shelton. The crickets were said to be eating holes in clothing and the wallpaper on the walls. It was suggested that a paste consisting of two cups of flour and a level teaspoonful of Paris green be made and distributed as a bait. The owner reported that dead crickets were observed the next day and that some of the paste had been eaten. It was also suggested that the bran-Paris green bait be used in addition to the other bait, and this was done within a few days.

On August 28 the second case was reported from West Haven, after the owner had used sprays and fly swatters to control the crickets. A few seemed to persist, however, and the bran-Paris green bait was recommended.

In both cases the houses were adjacent to dumps which were partially uncovered or not covered at all.

[J. PETER JOHNSON]

A small outbreak of a looper, *Ellopia athasaria* Walker, occurred during 1940 in two hemlock stands, one in Woodbridge and the other in Branford. At Woodbridge about seven acres were involved, the trees being 6 to 18 inches in diameter. The upper crowns of the larger trees were completely defoliated and the lower branches were affected to a greater or less extent. Some of the smaller trees were completely stripped. The young reproduction, however, was not injured. Inasmuch as the survival of these trees was doubtful, the stand was cut in the late fall. At Branford about two acres were involved. The trees were about the same size and the same type of injury, although slightly less pronounced, was observed (Figure 4). The larvae of this species mature in September. It hibernates in the pupal stage, and pupae were abundant in the undecomposed litter under the trees in the winter of 1940-1941. A sample taken at Branford yielded 35 to 50 per square yard close to the bases of the trees.

FIGURE 4. Hemlock trees at Branford partially defoliated by *Ellopia athasaria* Walker in 1940.

In 1927 Houser (Jour. Econ. Ent., **20**: 299-301) reported an outbreak which occurred in 1925 near East Liverpool, Ohio. The stand was mixed hardwood and hemlock, and although the hemlocks were most severely injured, red oak, white oak, beech, soft maple, and ironwood were fed upon to some extent. Many of the hemlocks died and were later attacked by bark beetles and borers. The outbreak lasted only one season.

In 1935 Schaffner (Insect Pest Survey, **15**: 273) reported an outbreak in a hemlock stand extending over about 10 acres in Warwick, Mass., in 1934. This outbreak was also of brief duration.

[R. B. FRIEND]

Last October Mr. Albert Morgan, of Rocky Hill, brought in to the Experiment Station a spider, *Mastophora cornigera* (Hentz), together with its apparently recently made cocoon. Mr. Morgan's attention was attracted by the oddness of the cocoon, a photograph of which is given here (Figure 5).

FIGURE 5. Egg cocoons of *Mastophora cornigera* Hentz, a spider new to New England.

This spider belongs to a genus of orb-weavers of which only two species, both quite rare, occur in Connecticut. They are both found in the southern and western states, though nowhere very commonly, and Mr. Morgan's specimen represents the first authentic record of *M. cornigera* for New England. They are the only members of the family in which the cephalothorax bears a pair of large, horny protuberances.

The females vary considerably in size, depending upon the state of gravidity, and southern specimens tend to be larger. *M. cornigera* varies from about 6 to 15 mm. long, and *M. bisaccata*, the other New England species of the genus, from about 6 to 11 mm. In both species there is marked sexual dimorphism, the males measuring from 1.5 to 3 mm. in length. It has been observed that the males undergo only a single molt after emerging from the egg sac, when they are already recognizable as being in the penultimate instar.

In addition to this peculiarity, and that of structure, the two species are quite remarkable in the character of their cocoons, which are flask-shaped, having more or less elongate neck and swollen base. The manner of attaching the cocoons to the surroundings differs in the two species. One of the cocoons brought in by Mr. Morgan has a base about 8 mm. in diameter and a "neck" about 6 mm. high. The cocoon is lashed at the base to a twig by a number of glossy, silken threads, which are attached to one side, carried around the twig and fastened to the other side. These threads are drawn so tightly that the cocoon sits quite firmly on the twig. The outer covering is of grayish brown color, and quite tough. McCook states that when cut open "the bowl is found to contain a ball of white silken floss, within which the eggs are deposited. This ball is fastened to a very tough twisted cord, that passes up through the neck, and which was the line by which the egg ball was suspended before the outer flask was spun around it." In all probability the tough texture of the outer covering is due to the action of a salivary secretion (as has been demonstrated by Montgomery for other spiders), and is not simply the result of spinning alone.

In *M. bisaccata* (Emerton) the cocoon is not fastened to a twig at the base, but rather by a long thread extending from the neck, so that the base hangs free. Emerton had found his at New Haven in 1880 on beech and oak trees; and one was brought in to the Experiment Station in April, 1935, by Mr. A. B. Brockett, who had seen it hanging from an apple tree on his farm in Clintonville. The base was 10 mm. in diameter and the suspension thread 55 mm. long. In color and texture this closely resembles the egg sac of *cornigera*, and from the fact that Emerton had taken his in October with the spider holding on to the sac it seems that the cocooning season also is the same as in that species. Besides differing in method of attachment, this cocoon differs from that of *cornigera* in that the lower portion of the bowl has a scalloped fringe with blunt points or processes. The whole resembles, at first glance, a young apple, of which the dried-up sepals are represented by the scalloped fringe.

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[1]Inasmuch as the articles in this Report written by members of the Department all bear the authors' names, they are not listed here.

[2]Bureau of Entomology and Plant Quarantine, U.S.D.A.

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