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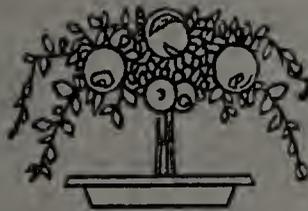
NINTH BIENNIAL REPORT

OF THE

MONTANA STATE BOARD  
OF HORTICULTURE

OF THE

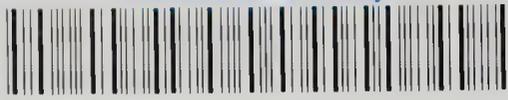
STATE OF MONTANA



FOR THE YEARS

1916-1917

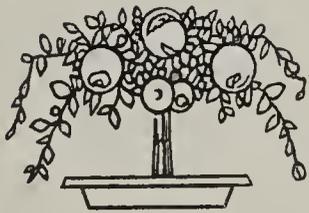
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NINTH BIENNIAL REPORT  
OF THE  
MONTANA STATE BOARD  
OF HORTICULTURE

OF THE  
STATE OF MONTANA



FOR THE YEARS

1916-1917

# Montana State Board of Horticulture

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**HON. SAMUEL V. STEWART**

Ex-Officio Member, Helena

---

**F. C. PICKERING, JOLIET**

First District

---

**T. T. BLACK, WHITEHALL**

Second District

---

**ALLEN PIERSE, GREAT FALLS**

Third District

---

**FRED T. PARKER, MISSOULA**

Fourth District

---

**ARTHUR V. PLATT, COMO**

Fifth District

---

**J. C. WOOD, BIG FORK**

Sixth District

---

**C. C. WILLIS, PLAINS**

Seventh District

---

**J. C. WOOD, President**

**M. L. DEAN, State Horticulturist**

**Office, Chamber of Commerce Building, Missoula**

## LETTER OF TRANSMITTAL

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Office of the State Board of Horticulture,

Missoula, Montana, January 1, 1917.

To His Excellency, Samuel V. Stewart,

Governor of Montana:

I herewith transmit to you as directed by the Act incorporating the State Board of Horticulture, this biennial report for the years 1915 and 1916 which contains a detailed statement of the receipts and expenditures of the Board in its regular operations, and the enforcement of the Alfalfa Weevil and White Pine Blister Rust Quarantines, the execution of which was made a part of the duties of the horticultural inspection division.

I trust that an inspection of the contents will convince you that the funds appropriated for developing, fostering and protecting the horticultural interests of the state have been wisely spent, and that the enforcement of the quarantine measures have been as judiciously executed as available funds would permit.

M. L. DEAN,  
State Horticulturist.

## FOREWORD

It has been said that horticulture is the refined essence of agriculture, agriculture being the basis of all wealth. There is no industry that affects human interests in so many ways as does horticulture. It furnishes a remunerative income to those who engage in its various specialties; it provides the table with our every day food and luxuries; and it satisfies the aesthetic taste in the decoration of the abode of those who would enjoy nature's gifts.

The adaptation and unusual possibilities of the various phases of horticulture to all parts of this state justifies the growing interest in the industry, and the increased demands by the public upon the different departments for information and advice.

The commercial orchardist, the builder of the home orchard and the fruit garden, and the man who has cast his lot upon the homestead with the family for which he wishes to build a home and decorate it with nature's gifts, trees and plants, all desire information and assistance in order that they may reap the greatest benefits therefrom.

For the past four years the horticultural industry in Montana has been passing through an evolutionary period. For a few years blight played sad havoc with the orchards which were planted largely with crabs and Alexanders, but in proportion to the eradication of these varieties the disease has become less and less prevalent until now there is but little annual damage. The existence of blight and other troubles in the orchard business discouraged many people and caused them to abandon fruit growing and turn their attention to a system of general farming.

A general readjustment of land values has been going on accompanied by somewhat of a depression which is simply a reaction such as always follows unwise speculative booming of any industry. This has been a benefit to the real fruit business in that it has eliminated many orchards that were unfavorably located as to soil and climatic conditions, and many that were planted with unsuitable varieties. Many fruit growers discovered the error of their selection and found that they were not fitted for the business. As a result of all of these changes fruit growing is on a more substantial basis than it was in 1912. The commercial acreage has been decreased, but the better orchards which are receiving up-to-date care are producing good results. In place of the large plantings of commercial orchards which prevailed a few years ago we now find in all parts of the state where it is being settled so rapidly numerous home orchards being planted, which in the aggregate will greatly increase the total orchard area of the state.

# Ninth Biennial Report

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Office of the State Board of Horticulture,  
Missoula, Mont., Jan. 1, 1917.

To His Excellency, Samuel V. Stewart, Governor of Montana.

TO THE GOVERNOR AND LEGISLATIVE ASSEMBLY OF MONTANA:

It is the purpose of this report to show the active operations of the State Board of Horticulture in connection with the horticultural interests of the state, and the enforcement of the quarantine measures toward the prevention of the introduction of insects or diseases dangerous to horticultural or agricultural interests. The first quarantine declared was against the introduction of the alfalfa weevil which so seriously threatens the valuable alfalfa interest of the state. The second was against the White Pine Blister Rust which is destroying the white pine forests of the European countries and the eastern portions of the United States where it has become established.

A description of the alfalfa weevil is given by State Entomologist, Professor R. A. Cooley, its habits outlined and the results of its work in Utah, Idaho and Wyoming, the states against which the quarantine is declared.

A description of the White Pine Blister Rust is also given and the part which the currant and gooseberry play in the spread of the disease.

The State Quarantine Commission is made up of the Governor (ex-officio), the State Entomologist, Professor R. A. Cooley of Bozeman and State Horticulturist, M. L. Dean. The executive operations of the commission were placed in the hands of the State Board of Horticulture because of the fact that the board already had a corps of inspectors located in all of the principal cities and towns in the state.

The Board in its official capacity has held meetings at stated intervals and convened for special purposes when it seemed advisable.

Owing to the changed conditions in the horticultural industry from that of development and planting to the active management of maturing and productive orchards the general inspection operations have been changed somewhat in order to keep pace with the advancement. While incoming nursery stock is being closely guarded to prevent the introduction of new pests the general inspection operations of incoming fruit has been broadened and intensified with an aim if possible to prevent the introduction into Montana orchards through the commercial channel of imported fruits the dangerous and injurious pests such as the codling moth, San Jose scale and other insects as well as diseases, from which our Montana orchard sections are yet free.

It has been the aim of the inspection to reach as far as possible all incoming shipments, especially car lots, but to cover every town and city in the state with inspection is a difficult matter, and for that reason we know that a few shipments are delivered without inspection. We appreciate the co-operation of the railroads and express companies in their assistance in giving us information relative to the introduction into the state and arrival of shipments at points of destination.

Many car shipments, and some less than car lots, have been inspected and upon finding them infected to a degree that would prevent their being marketed in the state and warrant their confiscation, have been permitted to be diverted to other states rather than subject the shipper to the loss by their being destroyed.

The members of the Board in their individual districts have voluntarily given unlimited time and attention to the general inspection work and have always assisted and advised with the local inspectors and State Horticulturist whenever possible.

In some of the cities and towns in the state the inspectors have been called upon to assist in the care of the shade trees and ornamental plantings, and

in some instances directed the spraying of them. We are always very glad to do this, believing that it stimulates the planting of trees and shrubs which enters so largely into the civic development of the community.

### Parcel Post Inspection

For the further prevention of the introduction of dangerous pests into the state through the avenue of parcel post shipments, terminal inspection of interstate mail shipments of plants and plant products, was established under the provisions of the act of March 4, 1915, by providing for terminal inspection of mail shipments of plants and plant products originating in other states or foreign countries.

Arizona, California, Florida and Montana are the only states having taken advantage of this federal measure. All shipments by mail into these states of florists' stock, trees, shrubs, vines, cuttings, grafts, scions, buds, fruit pits and other seeds of fruit and ornamental trees or shrubs, and other plant and plant products in the raw or unmanufactured state, except vegetable and flower seeds, are now subject to inspection by the state inspectors before delivery to the addressee, except such products as are shipped under the certificate of the Federal Horticultural Board.

### MONTANA HORTICULTURAL INSPECTORS

Dist. No.	County	Name	Location
1—Custer		Truman Ames	Miles City*
1—Custer		James H. Wyant	Terry*
1—Carbon		Geo. W. Burns	Edger*
1—Carbon		F. C. Pickering	Joliet*
1—Carbon		W. J. Crismas	Joliet*
1—Carbon		A. H. Holder	Joliet*
1—Carbon		B. W. Pierce	Fromberg*
1—Carbon		S. C. Seeds	Baker*
1—Carbon		J. L. D. Queen	Belfrey*
1—Carbon		L. P. Chapman	Red Lodge*
1—Dawson		J. C. Taylor	Glendive*
1—Park		J. R. Hathhorn	Livingston*
1—Big Horn		David Pease	Lodge Grass*
1—Columbus		J. E. Bessette	Park City*
1—Columbus		W. F. Volz	Columbus*
1—Yellowstone		R. E. Bancroft	Billings*
2—Lewis and Clark		S. H. Malcolm	Helena*
2—Beaverhead		H. H. Soper	Dillon*
2—Silver Bow		E. B. Kelley	Butte*
2—Gallatin		T. R. Parker	Bozeman*
2—Meagher		E. McCarver	Harlowton*
3—Cascade		W. A. Remington	Great Falls*
3—Fergus		D. L. Chamberlain	Lewistown*
3—Valley		A. H. Whitbread	Glasgow*
3—Hill		E. J. Skaar	Havre*
3—Sheridan		A. S. Newcomb	Mondak*
3—Sheridan		G. G. Ness	Plentywood*
3—Sheridan		Guy Clark	Dooley*
3—Sheridan		F. R. Devine	Bainville*
3—Teton		Geo. S. Durland	Cut Bank
4—Deer Lodge		M. J. Kelly	Anaconda*
4—Missoula		Edwin Fox	Missoula*
5—Ravalli		W. E. Pollinger	Hamilton*
5—Ravalli		Philip T. Baden	Woodside*
5—Ravalli		Arthur V. Platt	Como*
5—Ravalli		Chas. D. Shirley	Stevensville*
6—Flathead		J. C. Wood	Big Fork*
6—Flathead		John Ludwig	Kalispell*
6—Flathead		J. A. Fossum	Somers*
6—Flathead		R. A. McGrath	Whitefish
6—Flathead		Wm. E. Roney	Polson
6—Lincoln		George Moore	Troy*
6—Lincoln		A. C. Herbst	Libby
7—Sanders		W. J. Putnam	Plains*

\*Parcel Post Inspection Points.

M. L. DEAN,  
State Horticulturist.

MONTANA LICENSED NURSERIES TO JUNE 30, 1917

Name—	Address—
R. M. Kellogg Co.....	Three Rivers, Mich.
Oregon Nursery Co.....	Orengo, Oregon.
Farmer Seed & Nur. Co.....	Faribault, Minn.
Washington Nursery Co.....	Toppenish, Wash.
Toppenish Nursery Co.....	Toppenish, Wash.
Clinton Falls Nur. Co.....	Owatonna, Minn.
Wm. H. Moon Co.....	Morrisville, Pa.
Page-Clark Seed & Nur. Co.....	Billings, Montana.
Joseph Hooper .....	Billings, Montana.
Northwest Nursery Co.....	Valley City, N. D.
Northern Nursery Co.....	Denver, Colorado.
Howard Lake & Victor Nurseries.....	Howard Lake, Minn.
Gurney Seed & Nur. Co.....	Yankton, S. D.
Henry A. Dreer, Inc.....	Philadelphia, Pa.
O. H. Will & Co.....	Bismarck, N. D.
Sherman Nursery Co.....	Charles City, Iowa.
Billings Nursery Co.....	Billings, Montana.
Stark Bro's. Nur. & Orch. Co.....	Louisiana, Mo.
Salem Nursery Co.....	Salem, Oregon.
Jewell Nursery Co.....	Lake City, Minn.
Hankinson Nursery Co.....	Hankinson, N. D.
J. P. Callahan, Interstate Nursery.....	Bridger, Montana.
Froid Nursery Co.....	Froid, Montana.
Home Nursery, Fred Inabnit, Prop.....	Billings, Montana.
Capital City Nursery Co.....	Salem, Oregon.
Wedge Nursery Co.....	Albert Lea, Minn.
Owatonna Nursery Co.....	Owatonna, Minn.
State Nursery Co.....	Helena, Montana.
Rose Hill Nurseries.....	Minneapolis, Minn.
O. S. Chilcott.....	Silesia, Montana.
German Nursery & Seed House.....	Beatrice, Nebraska.
Deerfield Nursery Company.....	Medford, Minnesota.
Arlington Nurseries & Fruit Farm.....	Arlington, Nebraska.
L. L. May & Co.-Mayfield Nurseries.....	St. Paul, Minnesota.
Missoula Nursery Co.....	Missoula, Montana.
Pioneer Nursery Co.....	New Ulm, Minnesota.
Hamilton Nursery Co.....	Hamilton, Montana.

M. L. DEAN,  
State Horticulturist.

**MONTANA STATE BOARD OF HORTICULTURE**

**Statement November 30, 1915**

**RECEIPTS**

Regular Appropriation .....	\$13,500.00
Salary Secretary .....	1,000.00
Nursery Tags .....	1.20
Excess Inspection .....	1,354.02
Fruit and Nursery Stock Inspection .....	7,669.29
Nursery Licenses .....	700.00
Horticultural Spraying Tax .....	208.45
	\$24,432.96

**DISBURSEMENTS**

Expenses Board Members at Meetings .....	173.45
Traveling Expenses .....	408.70
Orchard Inspection and Spraying .....	7,388.16
Office Expenses .....	587.99
Publishing Proceedings State Horticultural Society .....	200.00
Fruit and Nursery Stock Inspection .....	8,034.43
Salary State Horticulturist .....	1,666.64
Salary Secretary .....	749.97
Spraying Machinery and Supplies .....	1,432.60
In First National Bank, Missoula .....	1,632.74
In State Treasury, General Fund .....	1,908.25
In State Treasury, Salary Secretary .....	250.03
	\$24,432.96

## MONTANA STATE BOARD OF HORTICULTURE

## INSPECTION DISBURSEMENTS BY DISTRICTS

	Orchard	Fruit and Nursery Stock
First District .....	\$ 567.28	\$ 1,906.54
Second District .....	333.11	2,953.24
Third District .....	17.50	2,001.11
Fourth District .....	2,061.21	1,517.12
Fifth District .....	3,647.61	1,038.90
Sixth District .....	959.86	602.01
Seventh District .....	524.30	3.25
	<u>\$ 8,110.87</u>	<u>\$10,022.17</u>

## MONTANA STATE BOARD OF HORTICULTURE

Statement November 30, 1916

## RECEIPTS

Regular Appropriation .....	\$13,500.00
Salary Secretary .....	1,000.00
Horticultural Spraying Tax .....	550.09
Nursery Tags .....	8.20
Maintenance Account .....	330.56
Excess Inspection .....	1,050.28
Fruit and Nursery Stock Inspection .....	8,316.35
Services State Horticulturist .....	208.37
Spraying Machinery and Supplies .....	42.35
Nursery Licenses .....	975.00
	<u>\$25,981.20</u>

## DISBURSEMENTS

Expenses Board Members at Meetings .....	\$ 141.25
Alfalfa Weevil .....	141.25
Traveling Expenses .....	809.24
Orchard Inspection and Spraying .....	7,536.42
Office Expenses .....	847.92
Inspectors Institute .....	113.65
Publishing Proceedings State Horticultural Society .....	150.00
Fruit and Nursery Stock Inspection .....	8,906.64
Services State Horticulturist .....	1,875.01
Salary Secretary .....	749.97
Special Services .....	282.10
Spraying Machinery and Supplies .....	1,147.23
In Missoula Trust & Savings Bank, Missoula .....	1,672.13
In State Treasury, General Fund .....	1,358.36
In State Treasury, Salary Secretary .....	250.03
	<u>\$25,981.20</u>

## INSPECTION DISBURSEMENTS BY DISTRICTS

	Orchard	Fruit and Nursery Stock
First District .....	\$ 549.52	\$ 1,866.07
Second District .....	119.15	2,571.99
Third District .....		1,941.67
Fourth District .....	1,954.74	1,230.43
Fifth District .....	4,104.00	296.41
Sixth District .....	455.13	611.79
Seventh District .....	348.88	1.00
	<u>\$7,531.42</u>	<u>\$8,519.36</u>

## FRUIT INSPECTED IN MONTANA

	1911	1912	1913	1914	1915	1916
Apples and Grabs.....	263,760	461,854	436,033	338,321	501,770	346,211
Pears .....	23,083	25,729	16,851	22,040	29,274	22,644
Peaches .....	119,175	138,249	114,711	205,695	228,049	204,433
Plums and Prunes.....	32,747	39,273	26,450	29,554	44,477	59,485
Cherries .....	18,657	29,357	20,462	28,035	32,070	14,488
Apricots .....	4,789	6,775	4,167	4,892	4,625	5,404
Quinces .....	539	565	513	364	400	214
Oranges .....	99,592	93,943	65,980	114,371	161,739	103,007
Lemons .....	25,702	32,208	29,441	27,907	50,138	33,093
Grapes .....	184,871	192,331	76,228	164,715	151,548	155,207
Strawberries .....	44,932	56,316	60,639	91,680	78,463	129,246
Blackberries .....	8,598	11,774	7,567	14,923	17,366	12,208
Raspberries .....	18,577	17,436	25,978	42,835	45,897	40,080
Dewberries .....	443	646	2,302	2,045	560	117
Blueberries .....	104	201	733	635	212	791
Currants .....	977	1,067	1,027	180	3,968	453
Gooseberries .....	856	563	739	824	1,292	297
Totals.....	847,402	1,108,287	889,821	1,089,016	1,351,848	1,127,378

## NURSERY STOCK INSPECTED IN MONTANA FOR THE FOLLOWING YEARS

	1911	1912	1913	1914	1915	1916
Roots .....	.....	.....	.....	.....	2,000	.....
Grafts .....	2,100	.....	.....	.....	.....	.....
Seedlings .....	491,711	136,763	.....	.....	.....	133,606
Apples and Crab Apples.....	189,425	209,413	123,850	219,889	96,699	42,663
Pears .....	7,528	9,733	5,263	7,993	3,936	1,140
Peaches .....	1,736	1,746	1,880	271	177	132
Plums and Prunes.....	8,489	79,521	14,395	271	9,128	13,897
Cherries .....	39,518	80,671	36,350	95,908	36,090	9,275
Apricots .....	824	459	440	16,623	50	85
Quinces .....	61	2	36	4,045	1	22
Grapes .....	673	3,464	7,323	16,121	2,594	3,390
Strawberries .....	42,793	99,161	184,320	316,813	170,870	203,660
Blackberries and Dewberries.....	7,038	18,929	9,216	35,513	3,892	5,011
Raspberries .....	18,159	46,523	49,108	121,138	21,224	26,485
Blueberries .....	.....	50	.....	113	226	323
Currants .....	4,816	5,604	19,928	19,479	7,957	13,039
Gooseberries .....	5,221	12,417	17,881	29,180	8,447	11,424
Shade .....	91,205	86,929	.....	.....	82,049	537,379
Ornamentals .....	41,803	50,725	.....	.....	23,882	116,512
Miscellaneous .....	761	.....	615,115	784,715	.....	541
Asparagus .....	.....	.....	.....	.....	1,060	.....
Totals.....	953,861	842,110	1,085,105	1,665,072	470,282	1,118,584

## FRUIT CONDEMNED

	1911	1912	1913	1914	1915	1916
Apples—(For Scab) .....	746	312	1993	3008	950	2315
Apples—(For Codl. Moth) .....	140	34	750	1688	1447	783
Apples—(For Scale) .....	196	238	20	111	640	388
Apples—(For Rot) .....				12		2
Apples—(For Worms) .....					450	40
Pears—(Scab) .....	2			3	2	90
Pears—(Worms) .....				420		86
Pears—(Scale) .....	146		10	47	32	169
Pears—(Codl. Moth) .....	72	151	318	622	360	452
Pears—(Blight) .....	7					
Pears—Scale and Worms .....						128
Peaches—(Codl. Moth) .....	57	7	46	763		
Peaches—(Twig Borer) .....	10		35			
Peaches—(Worms) .....						668
Plums—(Scale) .....				9		
Plums .....						
Apricots—(For Shot Hole Fungus) .....	14	40				
Apricots—(For Scale) .....		18		5		
Apricots—(Worms) .....	2					
Oranges—(Scale) .....	244	12		792	396	396
Oranges—(Worms and Scale) .....						300
Lemons—(Purple Scale) .....	183	336		1		
Raspberries—(Powdery Mildew) .....				1		
Raspberries—(Use of Old Boxes) .....				6		
Gooseberries—(For Powdery Mildew) .....	30	7				
Quinces—(Codl. Moth) .....					46	
Quinces—(Worms) .....						77
Miscellaneous—Violation Quarantine Law .....				32		1
	1849	1155	3172	7520	4323	5895

## NURSERY STOCK CONDEMNED

	1911	1912	1913	1914	1915	1916
Apple Trees—(Root Gall, Crown Gall, Hairy Root) .....	769	287				
Apple Trees—(Root Gall, Woolly Aphis) .....						20
Apple Trees—(Crown Gall) .....			210	1548		6
Apple Trees—(Blight) .....				3		
Pear Trees—(Root Gall, Crown Gall, Hairy Root) .....	20					
Pear Trees—(Root Gall) .....		9				
Cherry Trees—(Root Gall, Crown Gall, Hairy Root) .....	12					
Cherry Trees—(For Root Gall) .....		3				
Cherry Trees—(For Root Gall, Woolly Aphis) .....						5
Cherry Trees—(For Crown Gall) .....				107		
Peach Trees—(Root Gall, Crown Gall, Hairy Root) .....	10					
Plum Trees—(Root Gall, Crown Gall, Hairy Root) .....	10					
Strawberry Plants—(Woolly Aphis) .....						12
Shade Trees—(Crown Gall) .....						2
Shade Trees—(Woolly Aphis, Root Gall) .....						12
	821	299	210	1658		57

**COMPILED DATA OF ORCHARD CENSUS SECURED FROM ESTIMATES  
MADE BY COUNTY ASSESSORS, COUNTY AGENTS AND  
ORCHARD INSPECTORS**

COUNTY—	No. of Farms	Percentage having orchards or samll fruit growing thereon
Beaverhead .....	1200	1%
Big Horn .....	750	5 "
Blaine .....	2500	1 "
Broadwater .....	810	50 "
Cascade .....	1800	2 "
Carbon .....	1800	75 "
Chouteau .....	3500	5 "
Custer .....	2000	15 "
Dawson .....	4500	10 "
Deer Lodge .....	550	1 "
Fallon .....	3500	1 "
Fergus .....	8000	2 "
Flathead .....	3500	95 "
Gallatin .....	5500	60 "
Granite .....	420	10 "
Hill .....	5500	.01 "
Jefferson .....	900	65 "
Lewis and Clark.....	550	50 "
Lincoln .....	400	30 "
Madison .....	1150	10 "
Meagher .....	1250	1 "
Missoula .....	1050	92 "
Musselshell .....	4120	2 "
Mineral .....	131	10 "
Park .....	960	20 "
Phillips .....	1900	.01 "
Powell .....	2300	12 "
Prairie .....	1300	20 "
Ravalli .....	4500	95 "
Richland .....	2830	2 "
Rosebud .....	4500	1 "
Sanders .....	850	80 "
Sheridan .....	3000	1 "
Silver Bow .....	125	1 "
Stillwater .....	2500	75 "
Sweet Grass .....	1400	75 "
Teton .....	4786	.01 "
Toole .....	1850	.01 "
Valley .....	3500	1 "
Wibaux .....	1086	30 "
Yellowstone .....	9000	70 "

# FRUIT GROWERS!

## Spray Your Trees Thoroughly

### What For

**Oyster Shell Scale** } Just Before Buds Open  
 (Other Scale Insects) } Lime Sulfur Solution  
 1 to 9 of Water

**SCAB** } 1 When bud clusters begin to  
 APPLE } break showing pink color.  
 OR } 2. When petals begin to fall.  
 PEAR } Lime Sulfur Solution, 1 part to 25 of Water  
 3, 4, possibly 5. At intervals of 15 days, de-  
 depending upon weather conditions.  
 Lime Sulfur Solution, 1-30

**Blister Mite** } Before Buds Begin to Open  
 (In March)  
 Lime Sulfur Solution, 1 to 9

**Green Aphis** } Whenever Discovered  
**Blackleaf 40** } <sup>1 part 600 water. To</sup>  
 each 25 gal. water  
 add 1 bar soap.

**Woolly Aphis** } Tree Form---Blackleaf 40  
 1 to 600 water---Pressure 200 pounds  
 Root Form---  
 Expose Roots as far as infected. Apply  
 Blackleaf 40---1 to 600, Spring and Autumn

**Codling Moth** } 1. When Petals Begin to Fall  
 2. About Six Weeks.  
 2 pounds Arsenate of Lead--50 gallons water

**Bud Moth**  
**Green Apple Worm** } Arsenate of Lead  
 2 pounds to 50 gallons water  
**Canker Worm** }  
 (Any Leaf Eating Insect) } Can Be Combined With SCAB Spray

Lime Sulfur Dilutions are based upon 32° Beame test. "Blackleaf 40" can be combined with Lime Sulfur Solution for Aphis.

These spray materials can be secured in all towns. The BEST SPRAY OUTFITS should be used. Always use 150 to 200 pounds pressure.

PRUNE THOROUGHLY, BUT CAREFULLY---In blighted orchards carefully cut out all blight cankers and diseased wood, burning the same. For further information, address

**M. L. DEAN, State Horticulturist**

Missoula, Montana

# Inspection

## Orchard Inspection.

The policy as heretofore adopted has been followed during the past two years. In the Bitter Root valley the territory is divided into districts and one inspector is located in each district, whose duty it is to look after the general conditions of all orchards in his district as to the existence of pests; give information as to the best methods of control and report the existence of new pests found; to inspect all fruit and nursery stock coming into his district from other states, and fruit shipped from points within his territory.

In the other parts of the state the duties of the inspectors are about the same, but they cover a much larger scope of territory. Inspectors are maintained at all of the principal distributing points in the state. The orchard census data has been gathered as conditions warranted.

The general orchard conditions are good. There has been a gradual increasing demand for inspection work in bearing orchards because of the annual addition to the number of orchards reaching the producing age.

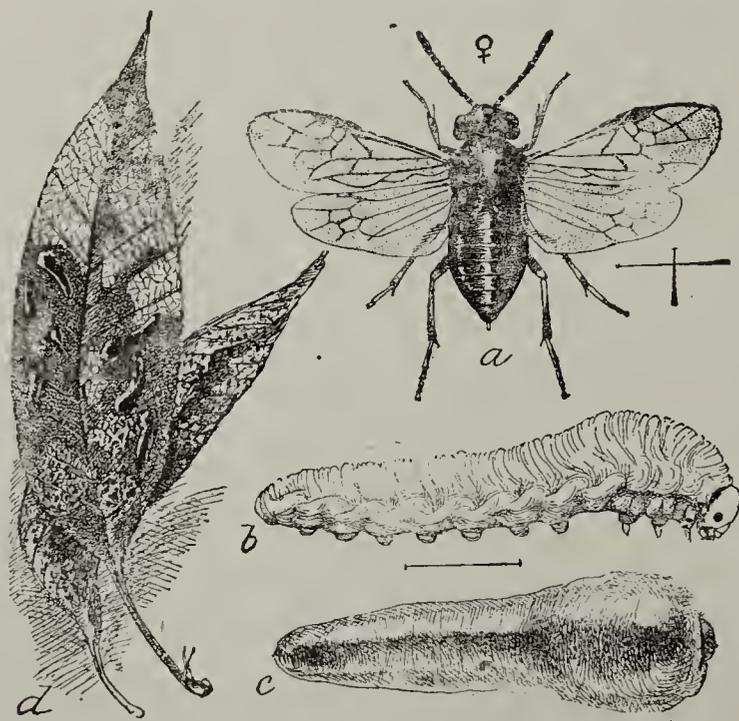
In the eastern part of the state the only pest that is to be found in the orchards is the green aphid, except one section in Carbon county where the canker worm did some damage for three seasons, but by thorough spraying with arsenate of lead it has been practically eradicated.

In the orchards west of the range the control of the apple scab is seriously attracting the attention of the growers, but where thorough systematic spraying is done the disease is absolutely controlled.

Blister Mite and Woolly Aphid are causing some trouble in the orchards in the Bitter Root valley. The blight was active for a short period in July, 1916, where transcendent crabs and Alexanders were to be found, but in orchards that are clean of these varieties there was no serious damage. When directions outlined on the field posters on opposite page of the spraying program published by the Experiment Station at Bozeman are followed all of the pests found in the orchards of Montana at present can be absolutely controlled.

### Pear and Cherry Slug

In some sections there is much damage being done to pear and cherry trees by the pear slug. This pest will appear on the foliage of the trees in the form of a soft slug. It destroys the green color of the leaf and gives the tree the appearance of turning brown and dying.



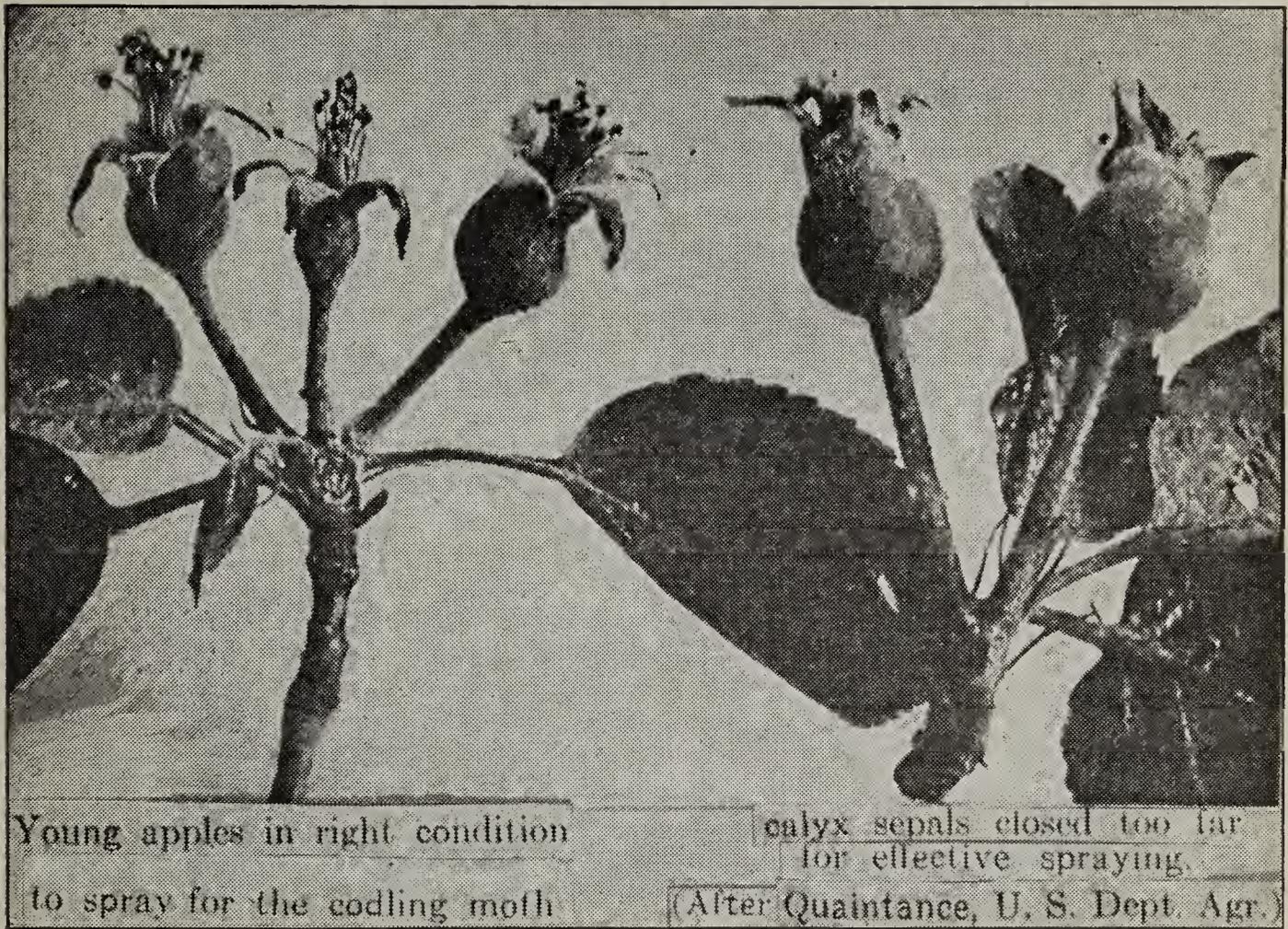
Pear and Cherry Slug

### Codling Moth.

Montana orchards are being closely guarded against invasion of the codling

moth. The orchard sections are yet free from this damaging pest and drastic measures are adopted when a colony is found in an orchard. Strict quarantine is enforced and thorough spraying required until the pest is eradicated.

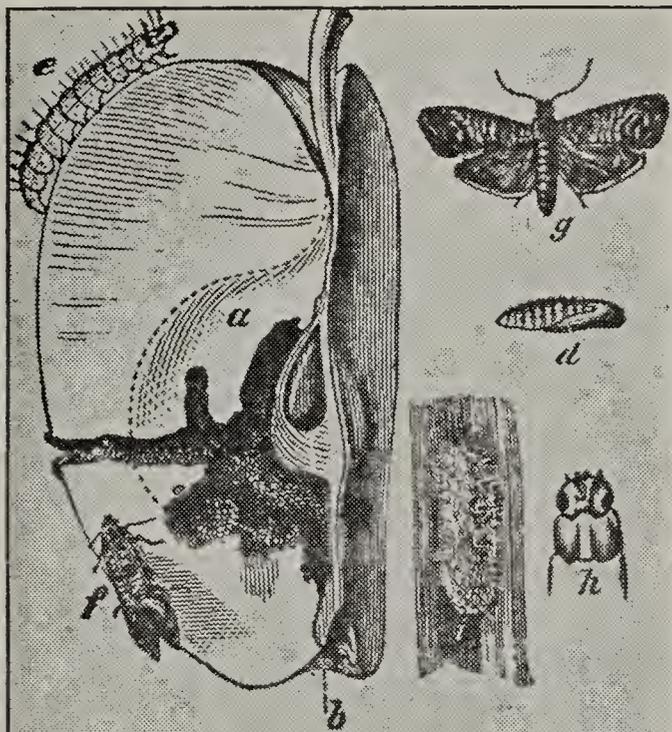
There have been several outbreaks in orchards, but in every case they have been exterminated. Thorough spraying, according to directions given in the spraying program will control this pest and also the bud moth.



Young apples in right condition to spray for the codling moth

calyx sepals closed too far for effective spraying.

(After Quaintance, U. S. Dept. Agr.)



The codling moth, *Carpocapsa pomonella*.—*a*, apple cut to show borings of the larva; *b*, place where the egg was laid and the larva started; *d*, pupa; *e*, larva; *f*, *g*, moths at rest and with wings spread; *h*, head of larva; *i*, cocoon.

## Remedy for Pear and Cherry Slug.

It is a very easy matter to control this pest by sifting through the tree air slacked lime or wood ashes. If the trees are too large for this operation spray with Black Leaf 40, or Lime Sulphur solution. All that are covered with the dust or spray solution will be killed.

Thoroughness, efficiency and proper application mean success.

## Frost Injury of Fruit.

There were many trees seriously injured by the severe freezing during the winter of 1915 and 1916. The bark in some instances entirely peeled from the trees, especially cherries, as the cuts indicate.

In many sections much fruit showed frost injury (as per cut) due to the late spring frosts. Some varieties, especially the Alexander, Duchess and Wealthy, were seriously injured in this way.



While spraying for control of the orchard pests is generally practiced, yet cases of neglected orchards and orchards in the cities and towns are attempted to be taken care of with state equipment. This is quite inadequate and unsatisfactory, especially in some of the cities where the shade trees are becoming infested with different troubles to the extent that they demand regular care. The ordinary orchard spray outfit does not have sufficient power to properly spray the tall shade trees, and all cities should provide their park boards with the large high power outfits so as to be able to prevent injuries to the trees and shrubs from the result of the ravages of the different pests. Some cities have recently purchased outfits.

It is of the utmost importance that a system of inspection should be established covering potatoes in order that this valuable industry in the state may

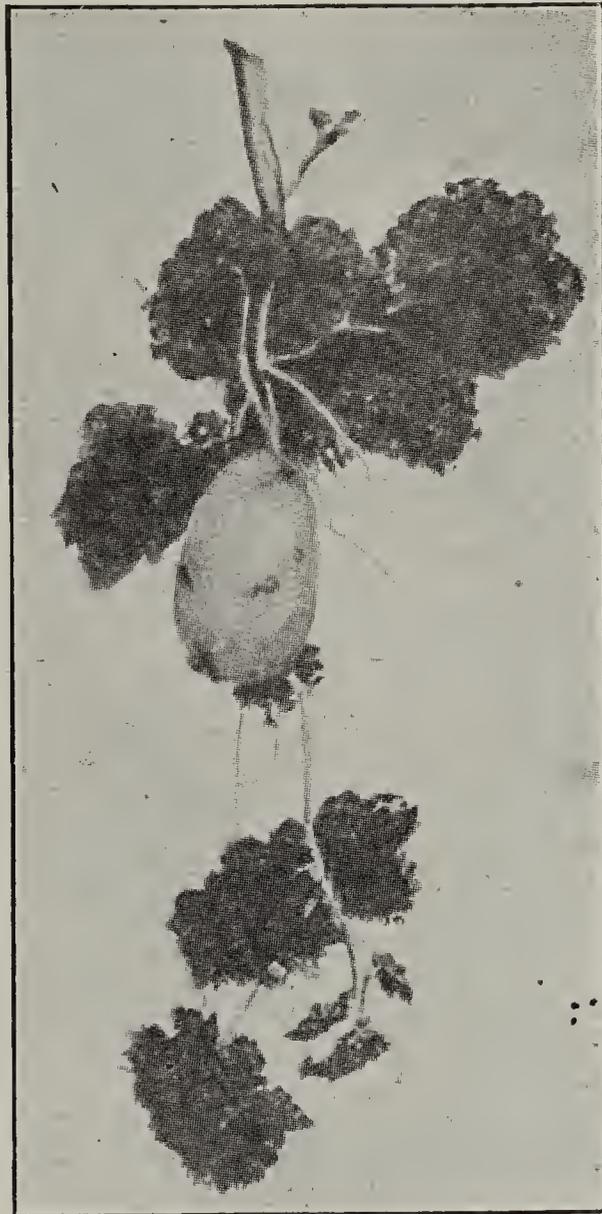
not be destroyed. There are several dangerous diseases to be found in the United States and Canada which are a serious menace to the potato growers, but there is no law under which we can inspect and destroy any diseased tubers found in the markets. Several carloads of California potatoes came into the state last spring badly infested with tuber moth, but we could not prevent their being distributed through the open markets.

### Potato Black Scab.

One of the most dangerous diseases of the potato is the Black Scab-Black Wart (see cut). It is a European disease against which the federal government has declared a rigid quarantine. It has been found on the continent and is probably the most dangerous of all potato diseases. The infected tubers become a putrid mass and it takes from five to seven years to eradicate the germs from the soil when once it becomes infected.

The "Powdery Scab" is a worse disease than the common potato scab, and growers should not send into eastern sections to secure seed because it is to be found in some of the eastern states.

We have recently co-operated with the Federal Horticultural Board to the extent that the horticultural inspector at Great Falls is authorized to inspect shipments of Canadian potatoes coming direct to that market.



### NURSERIES AND GREENHOUSES

The regular inspection of nurseries in the state has been conducted as heretofore. The stock both in the nursery row and storage cellars showed a remarkable degree of freedom from dangerous diseases and insects.

Several nurserymen conduct greenhouse plants in connection with their nurseries. The greenhouse industry of the state is in a very flourishing condition. New plants are being built and the old ones are overtaxed to supply

local trade, and also increased export demands. The growing of vegetables under glass is becoming very remunerative with some of the greenhouse men.

The value of an industry is not always represented by the actual dollars and cents it is worth. This is the direct value, but often there is an indirect value vastly greater.

The nursery business in Montana, viewed from this standpoint has a much greater indirect value than is given to it by a casual survey. When we look at the valuable orchards, the attractive gardens of shrubbery and flowers, the beautiful shade and floral decorations around the homes in the cities, towns and country, and try to fix a value on the numerous wind breaks in the open prairie sections, all of which are possible because of the nursery we can put an imaginative value upon the industry many times greater than the real intrinsic value shows.

The large commercial nurseries of the state as we find them today have developed with the large orchards and general community development over the state.

Nursery inspection is purely an American innovation. If it had been put into practice earlier in the foreign countries we would have had fewer pests to fight and less anxiety about the invasion of new pests. Nearly all states now have nursery inspection laws and all work in conjunction with the Federal Horticultural Board in trying to prevent new invasions and hold the enemies to plant life which we already have in check. Such inspection imposes no hardships upon the reputable nurserymen. In fact they all court it and are anxious to have very careful inspections frequently made. It is a precautionary measure in behalf of the planter and the industries for which the nurserymen are fundamentally responsible.

The general inspection system has already done much to prevent the spread of many injurious insects and diseases by preventing the selling and distribution of diseased stock.

Montana has about twenty greenhouses ranging in area from 10 000 to 50,000 feet of glass, each representing an annual business of from \$10 000.00 to \$35,000.00. The Missoula Nursery which operates in connection with the greenhouse covers an area of about fifty acres.

There is a greenhouse at Florence in which they specialize in growing vegetables, lettuce being their principal crop. Hamilton has a greenhouse in connection with the Hamilton Nursery which represents an annual revenue of about \$20,000.00. In connection with the Kalispell gardens is a greenhouse which has about 15,000 feet of glass.

These constitute the greenhouses west of the mountain range, while in the central and eastern part of the state there are several extensive plants. Helena, Billings, Great Falls, Lewistown, Bozeman, Livingston and some other cities have large up-to-date plants.

Montana has nine regular licensed nurseries operating from five to one hundred acres, representing an annual business of from \$5,000 to \$40,000:

Page-Clark Seed & Nur. Co., Billings, Mont.; Joseph Hopper, Billings, Mont.; Billings Nursery Co., Billings, Mont.; Inter-State Nursery Co., J. P. Callahan, Bridger, Mont.; Froid Nursery Co., Froid, Mont.; Home Nursery, Fred Inabnit, Prop., Billings, Mont.; State Nursery Co., Helena, Mont.; O. S. Chilcott, Silesia, Mont.; Missoula Nursery Co., Missoula, Mont.; Hamilton Nursery Co., Hamilton, Mont.

Buyers of nursery stock of any kind should aim to always get their trees or shrubs from licensed nurseries.

The nurseries located in other states who are licensed to operate in Montana are as follows:

R. M. Kellogg Co., Three Rivers, Mich.; Oregon Nursery Co., Orenco, Oregon; Farmer Seed & Nur. Co., Faribault, Minn.; Washington Nursery Co., Toppenish, Wash.; Toppenish Nursery Co., Toppenish, Wash.; Clinton Falls Nur. Co., Owatonna, Minn.; Wm. H. Moon Co., Morrisville, Pa.; Northwest Nursery Co., Valley City, N. D.; Northern Nursery Co., Denver, Colorado; Howard Lake & Victor Nurseries, Howard Lake, Minn.; Gurney Seed & Nur. Co., Yankton, S. D.; Henry A. Dreer, Inc., Philadelphia, Pa.; O. H. Will & Co., Bismarck, N. D.; Sherman Nursery Co., Charles City, Iowa; Stark Bros. Nur. & Orchard Co., Louisiana, Mo.; Salem Nursery Co., Salem, Oregon; Jewell

Nursery Co., Lake City, Minn.; Hankinson Nursery Co., Hankinson, N. D.; Capital City Nursery Co., Salem, Oregon; Wedge Nursery Co., Albert Lea, Minn.; Owatonna Nursery Co., Owatonna, Minn.; Rose Hill Nurseries, Minneapolis, Minn.; German Nurseries & Seed House, Beatrice, Neb.; Deerfield Nursery Co., Medford, Minn.; Arlington Nurseries & Fruit Farm, Arlington, Neb.; L. L. May & Co., Mayfield, Nurseries, St. Paul, Minn.; Pioneer Nursery Co., New Ulm, Minnesota.

### QUARANTINE

Under the quarantine law which is for the purpose of preventing the introduction of horticultural and agricultural insects and diseases much valuable work is being done. The enforcement of this law comes under the inspection division of the horticultural law. There is no special appropriation made for this work so the expense is maintained by the State Board of Horticulture. The importance of this inspection is not fully appreciated. A small appropriation should be made for it in order that the work can be extended to the greatest efficiency.

There have been two quarantines issued. The first one was the alfalfa weevil quarantine against Utah products. The second against the introduction of white pine, or any five-leaved pine nursery stock and currants and gooseberries to prevent the introduction of the White Pine Blister Rust which is so disastrous to the white pine interests in infected territory.

#### Alfalfa Weevil Quarantine.

The introduction of the alfalfa weevil into Montana would be one of the worst calamities which could befall the alfalfa interests of the state. In some counties it would completely demoralize the system of farm cropping, as alfalfa is one of the principal crops in the regular crop rotation. In other counties it is the leading forage crop, while the seed crop is of much value in sections where it is being developed.

According to the best available information received from the Department of Agronomy at the Agricultural College at Bozeman, there were at least thirty carloads of alfalfa seed raised in the state this year. Figuring 700 bushels to the car would mean more than 20,000 bushels, and at seven to ten dollars per bushel, the industry shows to be of much value to the state.

For hay, forage, pasture or other uses there are probably more than 500,000 acres in the state distributed in every county in the state.

Professor Alfred Atkinson of Bozeman, says: "According to the crop estimate of the United States government, Montana produced 852,000 tons of alfalfa hay in 1915. The value of this hay per ton was \$9.40, which gave a total value of the alfalfa crop for 1915 as \$8,008,800.00. The government places the estimate as \$10.90 a ton for the 1916 crop. Assuming the same production, it would make the value of the 1916 crop \$9,286,800.00.

"If you figure it at two tons per acre, which cannot be very far from correct when you figure in both the irrigated and dry land stuff, it amounts to 426,000 acres in alfalfa at the present time. Of course, irrigated alfalfa will go considerably above this, but there must be a lot of dry land alfalfa that does not go so high. On an average yield of two tons per acre with an average value of \$10.90 for this year, it would make a value of \$21.80 per acre for all the alfalfa in the state."

This valuation for hay and seed is only a small portion of the real value of this plant to Montana farmers in their real active farm operations.

In Utah, from where the weevil was first discovered in 1904 or 1905, it has gradually advanced by an annual spread of about ten miles per year. About one-half of the state of Utah, several of the southeastern counties of Idaho and a few counties in western Wyoming are now infested.

The U. S. Farmers' Bulletin No. 741 says of the weevil: "The insect attacks Utah's most important crop. Alfalfa furnishes 80 per cent of the value of the hay and forage crop of the state, which in turn is 40 per cent of the value of all crops. The 1909 crop was worth nearly \$6,000,000, according to the Thirteenth U. S. census. About one-half of the annual yield is harvested in the first cutting and about one-third in the second. The dam-

age to the first cutting ranges from slight depreciation of the quality of the hay to almost a total loss, varying according to the rate of growth and the time of harvest; it may be estimated at 50 per cent. The damage to the second cutting, if no effort is made to prevent it, amounts to a total loss. The menace to this state, therefore, involves one-half of the yield, worth \$3,000,000.

"Besides the loss represented by these figures; there is a less tangible, but equally serious, effect due to the peculiar relation of alfalfa to western agriculture. Because of its ability to revive after prolonged drouth, to produce abundant crops for many years without re-seeding, and to furnish a nearly complete ration for livestock, it has a great value for a region where the water supply is scanty, reseeding expensive and difficult, and live stock an important and increasing source of wealth."

Knowing this to be true relative to the state of Utah, it is difficult to measure by dollars and cents the damage that this pest would mean to the value of the alfalfa crop in Montana.

The weevil has not been found in Montana except in the instance described in the publication by State Entomologist, Prof. R. A. Cooley of Bozeman, which was the incentive to the declaring of the quarantine. Many reports of its discovery come to the office and immediate attention is given to trace the origin of the report and the possibility of an infestation. While the gradual spread of the insect may in time bring it into Montana, yet each year that its entrance is prevented means much to the state, and it also gives the federal and state forces more time to solve the problem of eradication or control.

The Office of Information, U. S. Department of Agriculture, in a recent publication, says: "The alfalfa weevil is spreading in a way which makes it possible that sooner or later every section of the country will have to consider the problem of guarding against this pest. During the twelve years since the weevil was introduced into America, it has been confined to the limits of the Great Basin of the West, but it has been found this year by the Bureau of Entomology at Malta, McCammon, Pocatello and Blackfoot, Idaho, all well within the Snake River drainage system, and at Duchesne, Utah, in the Colorado River system, which, like that of the Snake, slopes to the Pacific. Within the Great Basin the weevil has spread as far south as Richfield into the alfalfa fields of central Utah. The insect, in spreading across the continental divide, department entomologists say, is to be regarded merely as passing a convenient landmark rather than as surmounting a barrier, for experience has not shown that it spreads faster along rivers than across mountain ranges. Nevertheless, it is now many miles nearer to important alfalfa-growing districts which have heretofore felt safe from its attack.

A full description of the insect, its life habits and the text of the quarantine measure is given here by Prof. R. A. Cooley, State Entomologist.

#### THE ALFALFA WEEVIL\*

By R. A. Cooley, Entomologist, Montana Experiment Station, Bozeman, Mont.

Growers of alfalfa and business men generally in Montana view with apprehension the presence and rapid spread of the alfalfa weevil in neighboring states to the south. It is generally known that it has done great damage in Utah and that, until recently at least, there has been no known way to prevent the damage. It is quite natural, therefore, that interested persons in Montana should desire to have done everything possible to prevent or delay the introduction of this pest.

The alfalfa weevil (*Phytonomus posticus* Gyll.) is an old-world species. It occurs in Europe, western Asia and northern Africa, where it is not looked upon as an especially destructive species. It belongs to a genus, scientifically known as *Phytonomus*, all the members of which feed upon clover, alfalfa, and other plants belonging to the same plant family, (Leguminosae).

On account of the limited distribution of this insect very few entomologists have had actual experience with it. The information regarding the life

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\*Revised by the author from Circular 35, Montana Experiment Station, January, 1914, by authority of the Director.

history, habits, and distribution given in the following pages is drawn chiefly from the publications of the Utah Experiment Station and the United States Bureau of Entomology. Professor E. G. Titus, entomologist of the Utah Experiment Station, made a valuable contribution in 1910 in his bulletin No. 110 on the subject, and in 1912 Professor F. M. Webster added greatly to our information in his "Preliminary Report on the Alfalfa Weevil," bulletin No. 112, U. S. Bureau of Entomology. Professor Titus (1913) has published



Fig. 1.—Adult Alfalfa Weevil. (Much Enlarged.)

Acknowledgment—Our thanks are due the Bureau of Entomology, United States Department of Agriculture, for the loan of Figures 1-7, and to the Utah Experiment Station for Plates I and II.

"The Control of the Alfalfa Weevil," in Utah Experiment Station Circular No. 10. More recently the U. S. Department of Agriculture, Bureau of Entomology, has distributed a very valuable publication, which gives much information which is of interest to Montana. (Farmers' Bulletin 741, "The Alfalfa Weevil and Methods of Controlling It," by Reeves, Miles, Chamberlin, Snow and Bower).

In April (1913), following the passage of the quarantine law, State Horticulturist M. L. Dean and the writer went to Utah at the direction of the Governor of Montana, for the purpose of getting first-hand information about the weevil. Several days were spent with Federal and State officials and we were afforded every possible facility for getting the facts.

The Federal government is making extensive investigations concerning the weevil and is getting information of the greatest value. Mr. George I. Reeves, who is in charge of these investigations, gave us practical information of much importance.

The State inspection service, in charge of Mr. J. Edward Taylor, extended us many courtesies.

The writer made a second visit to Utah in the early part of September to get information regarding packing and shipping conditions.

In the spring of 1916 State Horticulturist M. L. Dean and the writer attended a conference at Salt Lake City at which representatives of seven western states were present, as well as representatives of the U. S. Bureau of Entomology and the State Board of Horticulture. The problems of preventing so far as is possible the further spread of the weevil was discussed at length. The conference adopted a series of recommendations, which were made the basis of the revised quarantine issued by the State of Montana on June 24, 1916.

### First Appearance in America and Present Distribution

Just when and how the alfalfa weevil was introduced into America will probably never be known. In the spring of 1904, several acres of alfalfa were seriously injured on a farm in the outskirts of Salt Lake, but not until 1907 was the attention of the Utah Experiment Station called to it. In 1908 Professor Titus called attention to it in the "Deseret Farmer," published at Salt Lake. Year by year it has spread over many miles and a recent bulletin of the U. S. Department of Agriculture shows it to be present in the following counties in that State: Box Elder, Cache, Rich, Summit, Wasatch, Sanpete, Millard, Juab, Tooele, Weber, Morgan, Davis, Salt Lake, Seiver, and Utah.

In Idaho it occurs in Bear Lake, Oneida, Cassia, Franklin, Bannock and Bingham counties and in Wyoming in Uinta and Sweetwater counties. So far as is known it does not occur elsewhere in the western hemisphere.

### Extent of Damage

In the State of Utah, in the region where this beetle has been working for some years, the acreage in alfalfa has been reduced by about one-third. When it first appears in a locality not much damage is done, but in a few years' time, if nothing is done to hold it in check, the results are most serious. The damage may range from one-quarter or one-third to complete destruction of the crop.

On the other hand, by methods described elsewhere the extent of the damage in recent years has been markedly reduced and the farmer who will follow approved methods thoroughly may do much to save his crop, but once in a locality the beetle is there to stay.

### Descriptions of the Insect and of the Injury

The injuries caused by this insect are most apparent on the first crop of the season when the larval feeding is at the maximum, or after the cutting of the first crop when the larvae attack the stubble and prevent the second crop from starting. At this time, seen at a little distance, the field has a distinctly whitened appearance. On closer examination the leaves are seen to be more or less riddled and whitened owing to a killing of the tissues between the veins.

The injuries are more apparent than the insects themselves. The larvae or "worms" which cause the greater part of the injury, are of the same color as the alfalfa leaves and are not noticeable, at least until the leaves have been much eaten.



Fig. 2.—Adults Clustering on and Attacking Alfalfa. (About natural size.)



Fig. 4.—Larvae Attacking Sprig of Alfalfa; Larva Enlarged at Right.

These alfalfa-green larvae, when full grown, are a little over one-fourth of an inch long, tapering from the middle toward each end, and have the surface raised into transverse ridges.

The young larva, soon after hatching, is very small, about one thirty-second of an inch in length, pale, dirty yellow in color, with the head somewhat darker. A few days later it takes on a greenish tinge, and gradually becomes a darker green.

As described elsewhere, the eggs are laid inside the stems. When the larvae hatch from the eggs they at first feed on the tissues on the inside of the stems.

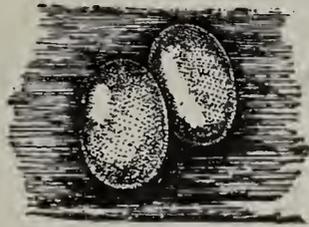


Fig. 3.—Eggs.  
(Greatly enlarged.)



Fig. 5.—Larva.  
(Much enlarged.)

After some three or four days, they come out and find their way to the leaf buds where the cluster of young leaves furnishes a hiding place. While here these very small worms are not easily seen. Later in the larval life they feed on the expanded leaves for the most part, although some continue in the buds. So abundant do these larvae become in cases of serious infestation that the plants become much eaten, are unable to develop properly, and serious injury to the crop results.

When fully grown the larva goes to the ground and spins a cocoon in the leaves or trash. This cocoon is made up of a net work of white fibers enclosing the insect and is oval in shape. Inside the cocoon the larva soon changes to a pupa which at first is pale green, but changes to pale brown as the adult stage is approached. From the pupa the adult beetle emerges.

The adult is one-eighth to three-sixteenths of an inch in length, oval in shape and, when freshly emerged, of a pale brown color with a darker line running down the back. In a few days the beetle goes to the plants, the body wall becomes harder and the color is deeper brown. Gray, brown and black hairs are mixed on the back, causing distinct, yet rather indefinite, spots. The head is extended forward and downward into a beak and the mouth parts are at the tip of this beak. With the aging of the beetles some of the hairs get rubbed off, causing such individuals to appear much darker. This rubbing may continue until the color is almost black.

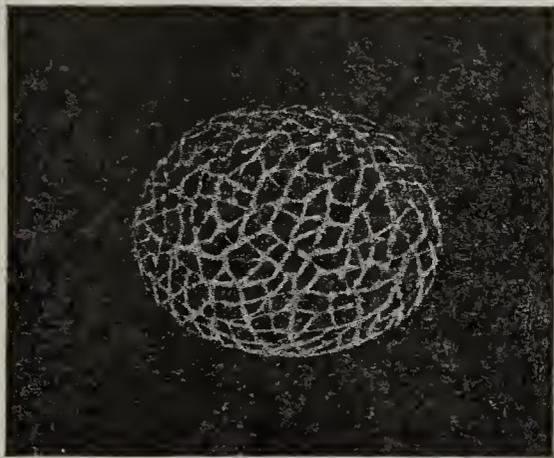


Fig. 6.—Cocoon.  
(Much enlarged.)

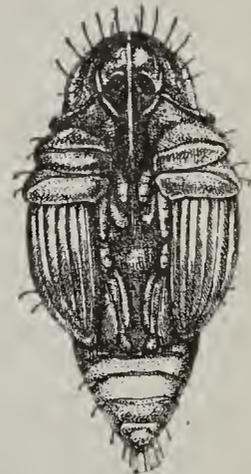


Fig. 7.—Pupa.  
(Much enlarged.)

More or less adult feeding is going on all the time from the opening of spring when the old brood comes out until about the first of August when the new brood goes into hibernation. In the spring the beetles feed principally on the stems, boring in with their beaks, thus interfering with the growth of the young shoots and seriously injuring the crop. Such injured stems may wither and break off.

Where control measures are not adopted, a considerable amount of damage may be done to the second crop by the feeding of the adults. When the stems are large and hard, the beetles feed on the softer epidermis of the stalks and on the leaves. When very abundant they may even completely defoliate the plants.

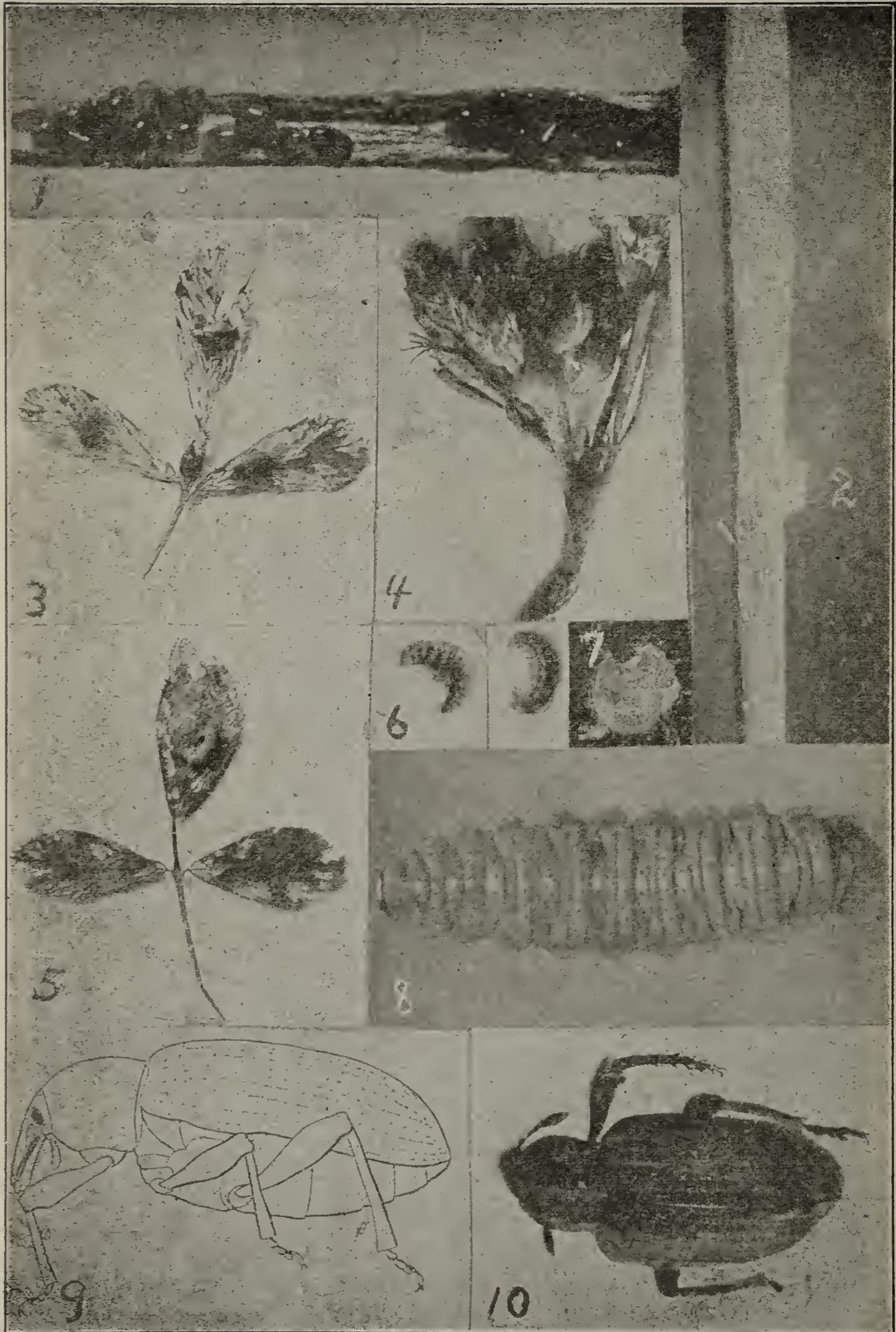


Plate I.—(1) Eggs in open stem (greatly enlarged). (2) Larva emerging from stem. (3) Adults feeding on leaf (natural size). (4) Larva feeding in bud (enlarged 2x). (5) Larva (natural size). (6) Larva (enlarged). (7) Cocoon. (8) Dorsal view of larva (enlarged 10x). (9) (10) Adult weevil (enlarged 10x).

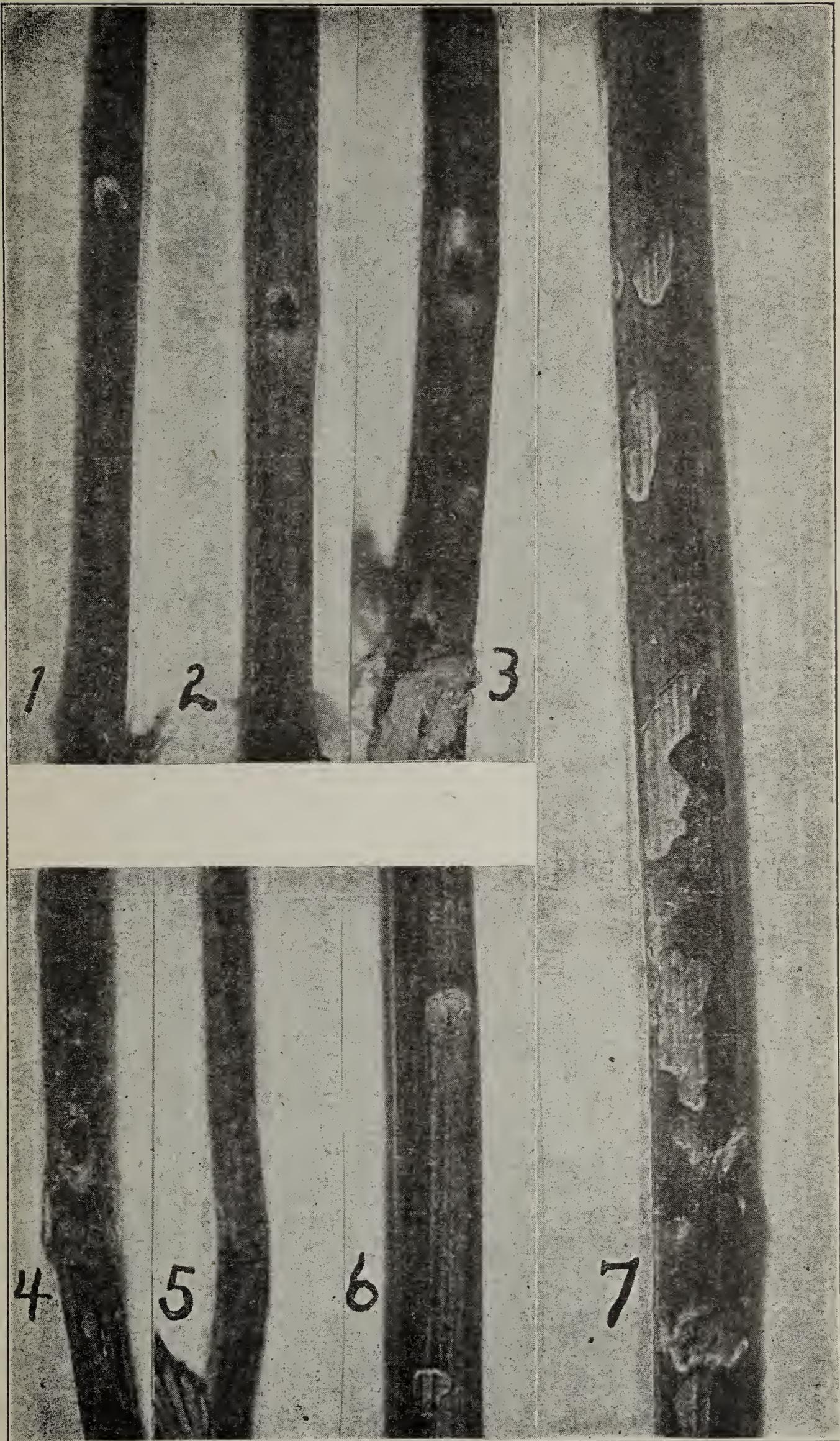


Plate II.—1-6, Stems Showing Feeding Punctures. 7, Stems Showing Epidermal Feeding.

Besides the so-called feeding punctures on the stems, there are others which penetrate into the interior of the stems and are made for the purpose of receiving the eggs. These are called the egg punctures. Many eggs may be laid in a single puncture.

These eggs are very small oval bodies, at first lemon yellow in color, later becoming darker.

### Life History

Early in the spring, as the alfalfa starts to grow, the adult beetles come out of hibernation and begin feeding on the young shoots. In a few days they begin to lay eggs in the characteristic egg punctures in the stems. They continue feeding and egg-laying for some weeks, even after the first-laid eggs begin to hatch.

The time of the first appearance of the beetles and the eggs varies, of course, with the season. Eggs may be found in abundance from the middle of April to the latter part of June and some may be found until fall.

The eggs hatch, according to Mr. Titus, in from seven to sixteen days. The time required varies with the temperature. The appearance of the larvae, is, of course, strung out through the season in accordance with the protracted egg-laying period.

After about a month or more of larval feeding the cocoon is formed, and about two weeks later the perfect beetle appears and crawls up on the alfalfa stems. The beetles feed for a time before going into hibernation and during this feeding period, along in July, they may sometimes be found clustered on the plants in astonishing numbers.

By about the first of August the beetles have completed their feeding and have crawled or flown away. Regarding the hibernation habits of this insect it may be said that for the most part they pass the winter near the ground, hidden away in waste material, or buried in the ground.

### How the Insect Spreads

A knowledge of the means by which this insect extends its range of distribution is of much interest as thereby we may better understand, how, if possible, to prevent its entrance into Montana.

The beetles pass the winter in the adult condition, and from the opening of spring until the arrival of cold weather are more or less active, particularly until about August first. Beginning about the first of July is a period of activity known as the "summer flight."

It is during the periods of activity, when the beetles may be found almost anywhere, that they are particularly liable to find their way into movable articles in which they may be taken by railroad trains into remote localities. The alfalfa weevil may arrive in Montana either by spreading from field to field or in connection with commercial practices and travel. If it comes by gradually spreading through contiguous territory, it will most likely come in through some mountain valley from the states to the south, in which case it will first appear in the edge of the state; but if it comes by transportation in merchandise, baggage, or other movable articles, it may turn up at any point.

Our immediate danger is from transportable articles coming from infested districts. The beetles may crawl into openings which would afford them protection or hiding. Alfalfa, hay, straw, materials used in packing nursery stock, packages of fresh fruit and vegetables, seed packages of all kinds, stock cars, passenger coaches, new or second-hand farm implements, bed rolls of laborers, household articles brought in by immigrants, wagons and horse feed of tourists,—all these and many others are means which may be used by the weevils for transportation.

In this connection it should be mentioned that so far as is known, though the beetle has been in the vicinity of Salt Lake City since 1904, or longer, it has not appeared elsewhere in America, excepting as it has spread through intervening territory. It is, of course, possible that it does occur in remote localities where it is not yet recognized.

From the foregoing it is apparent that we cannot, by any reasonable means, make ourselves perfectly safe from invasion by this insect; but it is clear that much may be done to delay its arrival and we may hold it back for many years.

### Control of the Weevil

In the infested territory in Utah a determined effort has been made, with the assistance of the State and Federal experts, to secure profitable crops in spite of the weevil, and the more thrifty of the farmers have met with good success. The methods need not be here discussed in detail as our farmers are not called upon to employ them and by the time they are needed here, if ever, they will probably be much improved. However, in passing it may be said that the method is to stimulate the first crop to rapid growth by cultivation, which results in early maturing so that it may be harvested just before the larvae, under ordinary conditions, would do their maximum damage. The removal of this first crop leaves a host of the larvae on a nearly bare field. Irrigation is delayed and the field is cultivated and brush-dragged. "This treatment if properly carried out should leave the field with a fine dust mulch over the surface and the alfalfa stems bare, all the leaves being torn off them." (Titus.) Not all the insects are destroyed by this treatment, but so large a proportion is killed that, after irrigating, the second growth starts off well and a satisfactory second crop is assured.

### Examination of Shipments Received at Butte in 1913

During the month of July, before the quarantine went into effect, an assistant from this office, under authority of the State Board of Horticulture, was stationed at Butte for the purpose of searching shipments received by the various merchants and commission houses of that city from the State of Utah. The Bureau of Entomology also detailed a man for the same purpose and the two worked together.

A careful search was made of both express and freight shipments and not only were the shipments themselves examined, but the express and freight cars also.

Weevils were found in three carloads of potatoes. One contained eight, one ten, and one twelve living weevils. After the return of our man the representative of the Bureau of Entomology found twenty weevils in a fourth car of potatoes.

We are informed that it is a common practice among the farmers in Utah to place a layer of hay, often alfalfa hay, in the wagon before loading the potatoes in order to prevent bruising. Another common practice is to carry along alfalfa hay to be fed to the horses while making a long haul to the railroad. It is not strange, therefore, that the weevils turned up in Butte, for during the active season they are almost certain to be found in the hay. These wagons are not always swept before they are used for another purpose and anything loaded from such wagons into cars, either directly or indirectly, is liable to contain weevils.

### Montana's Quarantine Law

"An Act to provide for the prevention of the introduction and spread of insect pests and diseases of horticultural and agricultural plants; and providing the penalties for violations of the provisions of this Act."

Be it enacted by the Legislative Assembly of the State of Montana:

Section 1. Whenever the Governor of the State has good reason to believe that any pest, gypsy moth, brown tail moth, Mediterranean fruit fly, potato wart, potato canker, black scab, potato eelworm, pea weevil, alfalfa weevil, alfalfa blight, flax canker, or flax wilt or other fruit or plant disease or insect pest dangerous or inimical to the horticultural or the agricultural industry exists in certain localities in another State, territory or country, or that conditions exist that render domestic horticultural stock or agricultural crops or plants likely to become diseased, he must by proclamation designate such localities and prohibit the importation therefrom of any tubers, plants, nursery stock, fruit or seeds or agricultural crops, plants or seeds likely to introduce or spread infection, contagion or insect pests into the State, except under such restrictions as he, after consulting with the State Board of Horticulture, the Commissioner of Agriculture or the State Entomologist may deem proper.

Sec. 2. Whenever the Governor of this State has good reason to believe that any pest, gypsy moth, brown tail moth, potato wart, potato canker, black scab,

potato eelworm, pea weevil, alfalfa weevil, alfalfa blight, flax canker or flax wilt or other plant disease or insect pest, dangerous or inimical to the agricultural industry, exists within any county or locality within the State, it shall be his duty to prescribe and enforce such rules, and regulations as may be necessary to circumscribe, eradicate or control such pests or disease.

Sec. 3. Any person, firm or corporation who after publication of such proclamation knowingly receives in charge any tubers, plants, nursery stock, fruit, seeds or agricultural crops, plants, or seeds from any of the prohibited districts and transports, conveys, sells or uses the same, within the limits of this State, is guilty of a misdemeanor and punishable by a fine of not less than ten (\$10.00) dollars or more than five hundred (\$500.00) dollars, and is further liable for any and all damages and loss that may be sustained by any person by reason of the importation or transportation of such prohibited and diseased tubers, plants, nursery stock, fruits, seeds, or agricultural crops, plants or seeds.

Sec. 4. All Acts and parts of Acts in conflict herewith are hereby repealed.

Sec. 5. This Act shall be in full force and effect from and after its passage and approval by the Governor.

Approved, March 8, 1913.

In conformity with this law Governor S. V. Stewart, under date of June 24, 1916, proclaimed the following revised quarantine:

### QUARANTINE PROCLAMATION

Whereas, it has become known to me that an injurious insect, popularly called the alfalfa weevil, and scientifically known as *Phytonomus posticus*, exists and is dangerously injurious to alfalfa in the State of Utah, and in certain counties in the State of Idaho, to-wit: Bear Lake, Oneida, Bannock, Franklin and Power, and in certain counties in the State of Wyoming, to-wit: Unida and Lincoln:

Now, therefore, I, S. V. Stewart, Governor of the State of Montana, under and by virtue of the authority conferred upon me by Chapter 61 of the Session Laws of the Thirteenth Legislative Assembly, do hereby declare and proclaim a quarantine against said State of Utah, and said counties of Bear Lake, Oneida, Bannock, Franklin and Power, in the State of Idaho, and the counties of Unida and Lincoln in the State of Wyoming, and forbid the importation into Montana of the following agricultural products and other articles, excepting under conditions and regulations as specified:

1. Alfalfa hay and other hays of all kinds, and cereal straws.

2. Fresh fruits and vegetables, exclusive of potatoes, excepting under the following regulations:

(a.) Shipments for Montana to be made only from points designated by the recognized State pest inspection officer of the State shipping into Montana, said officer to notify the State Horticulturist of the State of Montana by registered mail, or by telegraph, of the designation of all shipping points in the aforesaid State of Utah or counties of Bear Lake, Oneida, Bannock, Franklin and Power in Idaho, or counties of Unida and Lincoln in Wyoming; said notification to be sent, and its receipt to be acknowledged, before any shipments are made to the State of Montana from said designated points.

(b.) Shipments to be re-packed from orchard or field boxes into new, clean boxes, or other fresh containers.

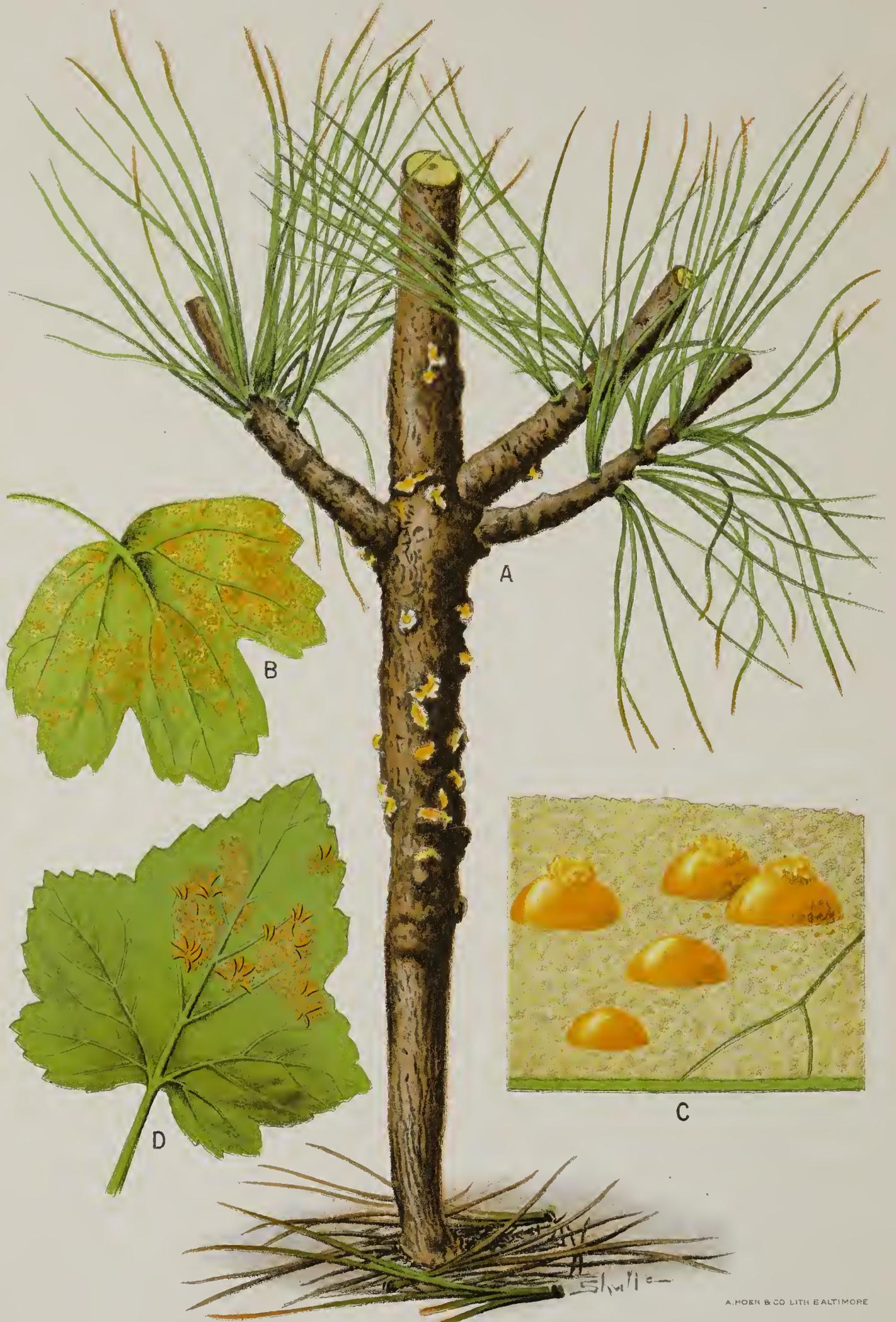
(c.) All wagons or other conveyances used in hauling to the place where re-packing is conducted to be kept free of alfalfa hay, other hays, straw, and all other means of contamination.

(d.) All packing houses to be at all times free of alfalfa hay, other hays, straw, and other means of contamination.

(e.) Each package to be plainly stamped or tagged with an official certificate of the State from which the shipment originates, stating that it has been inspected and passed in compliance with these regulations and stating where it was re-packed and inspected.

3. Potatoes unless accompanied by an official certificate signed by the recognized State pest inspection officer of the State from which such shipments of potatoes originate, setting forth that the potatoes have been passed





*CRONARTIUM RIBICOLA* ON *PINUS STROBUS* AND *RIBES*.  
(WHITE-PINE BLISTER RUST.)

over a screen, placed in fresh, clean sacks and packed in cars that are free of alfalfa hay or other means of contamination.

4. All nursery stock, unless accompanied by a special certificate setting forth that such nursery stock has been fumigated for the alfalfa weevil in an air-tight enclosure subsequent to being boxed, baled or packed for shipment, with cyanide of potassium or cyanide of sodium at the rate of one ounce to each one hundred cubic feet of enclosed space.

5. All agricultural emigrant movables, unless accompanied by an official certificate of inspection made under oath and setting forth that such agricultural emigrant movables have been inspected and found to be free of contamination by alfalfa hay, all other hays, and cereal straw.

6. All railway shipments of livestock unless shipped in cars that are free of alfalfa hay, all other hays, and cereal straw, throughout all that portion of the journey that is within the State of Utah and counties of Bear Lake, Oneida, Bannock, Franklin and Power in Idaho, and counties of Unida and Lincoln in Wyoming.

All Horticultural Inspectors of the State of Montana are hereby instructed and required to refuse admission into the State of Montana to all such articles as are herein designated from said State of Utah and counties of Bear Lake, Oneida, Bannock, Franklin and Power in Idaho, and counties of Unida and Lincoln, in Wyoming, except under the conditions herein enumerated. If any such articles as are hereinbefore listed be shipped into the State of Montana in violation of this quarantine they must be at once destroyed or returned to the shipper at his expense.

This quarantine shall not be construed to interfere with shipments of produce to the Yellowstone Park over the Oregon Short Line Railroad, and to Idaho points via Montana over the Gilmore and Pittsburgh Railroad.

This quarantine shall take effect and be in force on and after the first day of July, A. D. 1916.

It is specifically understood and intended that this quarantine proclamation shall revoke all previous proclamations on this subject by me made.

In Witness Whereof, I have hereunto set my hand and caused the Great Seal of the State to be affixed.

Done at Helena, the Capital, this the twenty-fourth day of June, in the year of our Lord one thousand nine hundred sixteen.

By the Governor: (Signed) S. V. STEWART.

(Signed) A. M. ALDERSON,  
Secretary of State.

The quarantine is in force only during the season of the year when the adult weevils are active and hence liable to be found in the classes of articles listed.

It is realized that with this quarantine established and rigidly enforced, there yet are ways in which the weevil may be brought in. An absolute closing of all possibilities is quite out of the question. Travelers' baggage cannot be excluded or searched, yet such baggage may carry the insects. The quarantine is intended to be as effective as possible and yet to be reasonable, and it is believed that the greater part of the danger of introducing this pest is removed.

It should be borne in mind, too, that the weevil is coming in our direction by its natural spread northward. Each year finds it a few miles closer to our boundary and we know of nothing in the intervening territory to prevent it from eventually reaching here.

### WHITE PINE BLISTER RUST QUARANTINE

This quarantine which prevents the shipping into the state of any five-leaved pine, currant or gooseberry nursery stock from any foreign country, state or territory, which may be or hereafter become infected, was declared as a protection to the white pine forests of the state. The disease may be carried on any five-leaved pine, currant or gooseberry nursery stock. A white pine brought into the state as a shade tree in some yard might bring the disease, and from it spread to the forest area.

It is a very serious menace to the white pine interests of the country. In the United States it is estimated that the value of the white pine forests

exceeds \$425,000,000. The disease not only kills the mature timber but also the young white pines growing up to take the place of those being cut. From the U. S. Division of Forestry, Missoula, we learn that in Montana it is estimated that there is in our national forests more than 32,000,000 B. M. of saw timber. This is made up of approximately the following species and per cents:

Lodge Pole Pine.....	36%
Douglas Fir .....	21%
Western Larch .....	14%
Yellow Pine .....	10%
Engelmann Spruce .....	9%
White Pine .....	2%
Miscellaneous .....	8%
	100%

The total value of the mature timber on the National Forests of Montana is estimated to be nearly \$40,000,000, including all the merchantable timber. In Montana there are 16,104,734 acres of National Forest and 2,872,691 acres of other forests, making a total of 18,977,425 acres.

It is impossible to get accurate data as to the value of the different types of timber but a conservative estimate of the area shows of merchantable timber:

Yellow Pine .....	1,429,000	acres
Douglas Fir .....	1,513,100	"
Lodge Pole Pine .....	5,101,000	"
Larch Fir .....	2,046,400	"
Engelmann Spruce .....	532,300	"
Cedar-Hemlock .....	11,200	"
White Pine .....	347,400	"
	10,980,400	"

This gives something of an idea of the value of the pine forests in the state and shows the necessity of protecting them from the invasion of this disease, which would mean their destruction. The disease exists in many of the eastern states and was found in Wisconsin and Minnesota nurseries last season. Drastic measures are being taken to eradicate it as these are the only two states west of the Mississippi in which it has been reported.

Prof. H. T. Fernald of the nursery inspection division in Massachusetts gives a full description of the life history of the disease in which he says:

This disease which has recently appeared in the United States has come here from Europe. In that country it probably lived on the stone pine (pinus cembra), but when the American white pine began to be grown there, it found in it another host on which to live, and apparently thrives better on this than on its original food.

It undoubtedly reached this country, not once but many times, on pines sent here from Europe, and it is now known to occur in at least half a dozen states and probably more. As no pine with the disease has ever been known to recover, and as it can live on all the different kinds of five-leaved pines, the disease is a dangerous menace to pines for timber, for ornament, to the lumber business, and to all those connected with it who either own the trees, cut the timber, use the wood in any way, or have anything to do with pine in any of its forms. It does not live on the two-leaved or the three-leaved pines.

Efforts are now in progress to arrest the spread of the disease and eliminate it before it goes any farther, and fortunately its life is such as to make this much easier than in the case of many diseases.

### Life History

The pine blister rust is a plant, living as a parasite in pines for a part of the time and in currants and gooseberries for the remainder. A seed (spore), which is carried by the wind, perhaps, from a diseased currant bush in the fall to the bark of a pine, sprouts there and sends its roots through the inner bark of the tree in that region, and this growth of the roots of the disease may continue for several years. The bark in this region often becomes much thicker than elsewhere as a result, or it may die, killing the tree before the

disease shows on the surface of the bark. Sooner or later, however, if the tree does not die first, the rust grows out through the bark, and in the spring forms masses of yellow seeds there, covered at first by a whitish covering which soon breaks, and the seeds are blown about. If any of them are blown on to currant or gooseberry leaves, these seeds sprout and the roots grow all through the leaves for a short time. After about two weeks these roots grow out to the surface, and there produce seeds which can be blown by the wind and which can produce the disease in other currants or gooseberry leaves in the same way. This process usually occurs about three times during the summer, but as fall comes on the last set of seeds produced is different, for these cannot spread the disease farther on currants, but only on the pines. The seed produced by the disease in the pines cannot produce it on other pines, but only on currants and gooseberries, while the first sets of seeds formed in these cannot start the disease in pines, only the fall-formed seeds being able to grow in pines.

### Treatment

The treatment, therefore, is to destroy all pines having the disease as fast as it shows itself on them, and to keep all currants and gooseberries so far away from pines that the disease cannot carry from one to the other in either direction. The distance apart to insure this is not positively known, but it is believed that one-third of a mile or 500 yards should be sufficient.

The colored plate gives a picture of a young pine showing the swelling of the stem and also the groups of yellow seeds ready to be blown to currants. (Fig. A.) It also shows currant leaves with the rust on them in the first stage (Fig. B) and in the second stage (Fig. D), and enlarged figures showing the appearance of the rust under the microscope in the first stage (Fig. C).

To find the disease, look on the pines from the first of May till the end of June.

On the currants it shows from the middle of July till the leaves drop in the fall.

Currants free in July and August may catch the disease during the summer from others, and first show it in September. Black currants are attacked more generally than other kinds of currants or gooseberries.

If anything suspicious is found, either on pines, currants or gooseberries, please write to the State Horticulturist, Missoula, Montana, and send samples if possible.

The text of the quarantine measure is herein.

### WHITE PINE BLISTER RUST QUARANTINE

Whereas, It has been confirmed by federal authorities that the White Pine Blister Rust (*Piridermium strobi*) is prevalent in several of the eastern states, viz.: New Hampshire, Vermont, Massachusetts, Connecticut, New York, Pennsylvania; and in addition to the known infected areas other localities are suspected of harboring the disease; and

Whereas, There is danger of the introduction of this disease into the great white pine forests of the State of Montana through shipments of the five-leaved pines, currant and gooseberry bushes;

Therefore, I, S. V. Stewart, as Governor of the State of Montana, do hereby order and declare that a quarantine be and is hereby established against the importation of any of the five-leaved pines, currant and gooseberry bushes from the above named states.

All quarantine guardians and deputy state horticultural inspectors are hereby instructed and required to refuse admission into Montana of any shipments of nursery stock of five-leaved pines, currant and gooseberry bushes from the above named states. It shall be the duty of the deputy horticultural inspectors, or other quarantine guardians, to immediately deport such shipments or destroy them by burning.

All expense incurred in deporting or destroying such shipments shall be paid by the consignee or owner.

Any person who sells or offers for sale, within the State of Montana, pine seedlings, currant or gooseberry bushes from the above named states in viola-

tion of this quarantine order will be liable to prosecution under the state laws.

In Witness Whereof, I have hereunto set my hand and caused the Great Seal of the State to be affixed.

Done at Helena, the Capital, this, the seventeenth day of July, in the year of our Lord one thousand nine hundred sixteen.

By the Governor: S. V. STEWART.

A. M. ALDERSON,  
Secretary of State.

SPRAYING PROGRAM (From Circular 36, Montana Agricultural Experiment Station.)

Combinations to be sprayed for	I				III When petals have nearly all fallen.	IV Two weeks later.	Notes. (At end of table.)
	Dormant. Just before leaf buds open	II Just before flower buds open ("in the pink")	III When petals have nearly all fallen.	IV Two weeks later.			
Scab. Oyster-shell scale (or blister-mite).	Lime-sulphur. With no blister-mite omit	Lime-sulphur.	Lime-sulphur.	Lime-sulphur.	Lime-sulphur.	Note 4.	
Scab. Green aphid (or woolly aphid)	Omit.	Lime-sulphur.	Lime-sulphur.	Lime-sulphur with tobacco extract.	Lime-sulphur.	Notes 1 and 4.	
Scab. Codling moth (or bud moth)	Omit.	Lime-sulphur.	Lime-sulphur.	Lime-sulphur with arsenate of lead, 2 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Notes 2, 3 and 4.	
Scab. Green fruit worm.	Omit.	Lime-sulphur with arsenate of lead, 4 to 50.	Lime-sulphur.	Lime-sulphur.	Lime-sulphur.	Note 4.	
Scab. Oyster-shell scale (or blister-mite). Green aphid (or woolly aphid)	Lime-sulphur. With no blister-mite omit	Lime-sulphur.	Lime-sulphur.	Lime-sulphur with tobacco extract.	Lime-sulphur.	Notes 1 and 4.	
Scab. Oyster-shell scale (or blister-mite). Codling moth (or bud moth)	Lime-sulphur. With no blister-mite omit	Lime-sulphur.	Lime-sulphur.	Lime-sulphur with arsenate of lead, 2 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Notes 2, 3 and 4.	
Scab. Oyster-shell scale (or blister-mite). Green fruit worm.	Lime-sulphur. With no blister-mite omit	Lime-sulphur with arsenate of lead, 4 to 50	Lime-sulphur.	Lime-sulphur.	Lime-sulphur.	Note 4.	
Scab. Green aphid (or woolly aphid) Codling moth (or bud moth)	Omit.	Lime-sulphur with arsenate of lead, 4 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Notes 1, 2, 3 and 4.	
Scab. Green aphid (or woolly aphid) Green fruit worm.	Omit.	Lime-sulphur with arsenate of lead, 4 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Lime-sulphur.	Notes 1 and 4.	
Scab. Codling moth (or bud moth) Green fruit worm.	Omit.	Lime-sulphur with arsenate of lead, 4 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Notes 2, 3 and 4.	
Scab. Oyster-shell scale (or blister-mite). Green aphid (or woolly aphid) Codling moth (or bud moth)	Lime-sulphur. With no blister-mite omit	Lime-sulphur with arsenate of lead, 4 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Notes 1, 2, 3 and 4.	
Scab. Oyster-shell scale (or blister-mite). Green aphid (or woolly aphid) Green fruit worm.	Lime-sulphur. With no blister-mite omit	Lime-sulphur with arsenate of lead, 4 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Lime-sulphur.	Notes 1 and 4.	
Scab. Green aphid (or woolly aphid) Codling moth (or bud moth) Green fruit worm.	Omit.	Lime-sulphur with arsenate of lead, 4 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Lime-sulphur with arsenate of lead, 2 to 50 and tobacco extract.	Lime-sulphur with arsenate of lead, 2 to 50	Notes 1, 2, 3 and 4.	

Scab. Oyster-shell scale (or blister-mite). Codling moth (or bud moth) Green fruit worm.	Lime-sulphur. With no blister-mite omit	Lime-sulphur with arsenate of lead, 4 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Lime-sulphur with arsenate of lead, 2 to 50	Notes 2, 3 and 4.
Scab. Oyster-shell scale (or blister-mite). Green aphid (or woolly aphid) Codling moth (or bud moth) Green fruit worm.	Lime-sulphur. With no blister-mite omit	Lime-sulphur with arsenate of lead, 4 to 50.	Lime-sulphur with arsenate of lead, 2 to 50 and tobacco extract.	Lime-sulphur with arsenate of lead, 2 to 50	Notes 1, 2, 3 and 4.
Oyster-shell scale (or blister-mite). Green aphid (or woolly aphid)	Lime-sulphur.	Omit.	Tobacco extract with soap.	Omit.	Note 1.
Oyster-shell scale (or blister-mite). Codling moth (or bud moth)	Lime-sulphur.	Omit.	Arsenate of lead, 2 to 50.	Arsenate of lead, 2 to 50.	Notes 2 and 3.
Oyster-shell scale (or blister-mite). Green fruit worm.	Lime-sulphur.	Arsenate of lead, 4 to 50	Omit.	Omit.	
Green aphid (or woolly aphid) Codling moth (or bud moth)	Omit.	Omit.	Arsenate of lead, 2 to 50, with tobacco extract	Arsenate of lead, 2 to 50.	Notes 1, 2 and 3.
Green aphid (or woolly aphid). Green fruit worm.	Omit.	Arsenate of lead, 4 to 50 with tobacco extract.	Omit.	Omit.	Note 1.
Codling moth (or bud moth) Green fruit worm.	Omit.	Arsenate of lead, 4 to 50	Arsenate of lead, 2 to 50.	Arsenate of lead, 2 to 50.	Notes 2 and 3.
Oyster-shell scale (or blister-mite). Green aphid (or woolly aphid). Codling moth (or bud moth).	Lime-sulphur.	Omit.	Arsenate of lead, 2 to 50, with tobacco extract	Arsenate of lead, 2 to 50, with tobacco extract.	Notes 1, 2 and 3
Oyster-shell scale (or blister-mite). Green aphid (or woolly aphid) Green fruit worm.	Lime-sulphur.	Arsenate of lead, 4 to 50 with tobacco extract	Omit.	Omit.	Note 1.
Green aphid (or woolly aphid) Codling moth (or bud moth) Green fruit worm.	Omit.	Arsenate of lead, 4 to 50	Arsenate of lead, 2 to 50, with tobacco extract	Arsenate of lead, 2 to 50.	Notes 1, 2 and 3.
Oyster-shell scale (or blister-mite). Codling moth (or bud moth) Green fruit worm.	Lime-sulphur.	Arsenate of lead, 4 to 50	Arsenate of lead, 2 to 50.	Arsenate of lead, 2 to 50.	Notes 2 and 3.
Oyster-shell scale (or blister-mite). Green aphid (or woolly aphid) Codling moth (or bud moth) Green fruit worm.	Lime-sulphur.	Arsenate of lead, 4 to 50 with tobacco extract	Arsenate of lead, 2 to 50, with tobacco extract	Arsenate of lead, 2 to 50.	Notes 1, 2, and 3.

Note 1.—If either kind of aphid appear later, spray with tobacco extract and soap. For treatment of the root form of the woolly aphid, see Circular 17, Mont. Agr. Exp. Station, page 128.

Note 2.—For discussion of the August spraying for the codling moth, see Circular 17, Mont. Agr. Exp. Station, page 137.

Note 3.—In case the bud moth, but not the codling moth, is present, the arsenate of lead in the spray applied two weeks after the petals fall may be omitted.

Note 4.—For discussion of a later spray for scab, see Circular 37, Mont. Agr. Exp. Station

The courtesies extended by the Montana Experiment Station at Bozeman for the spraying program; Professor R. A. Cooley, State Entomologist of Bozeman for his treatise on the alfalfa weevil; Professor Alfred Atkinson's information regarding the alfalfa industry of Montana; the Forestry Division at Missoula and Professor H. T. Fernald of the Horticultural Commission of Massachusetts are all greatly appreciated.

All of which I respectfully submit.

M. L. DEAN,  
State Horticulturist.





