

UNIVERSITY OF IDAHO  
AGRICULTURAL EXPERIMENT STATION  

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DEPARTMENT OF HORTICULTURE

INSECT PESTS  
OF THE  
ORCHARDS AND GARDENS OF IDAHO  
AND THEIR CONTROL

By W. C. EDMUNDSON,

BULLETIN NO. 87

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## INTRODUCTION

This bulletin is designed to convey practical information to the orchardists, gardeners, and others who are interested in any way in the growing of fruits and vegetables in the State of Idaho. It is divided into three parts; (1) insect pests of the orchard, (2) those of the gardens, and (3) spray materials. It has been the aim of the author to eliminate all technical terms that might be confusing to the average reader. There may be less important pests found in the state that are not mentioned in this publication; also some important insects of certain sections may have been overlooked. If growers are uncertain about insects found in their orchards and gardens, specimens should be sent to the Idaho Experiment Station for identification. Insects sent thru the mail should be packed in cotton in a small box so they will not be broken in transit. Caterpillars and similar soft specimens may also be sent, but should be placed in a four percent formalin solution. If possible, all specimens should be accompanied with some of the injured plant food upon which they feed.

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## Orchard Pests

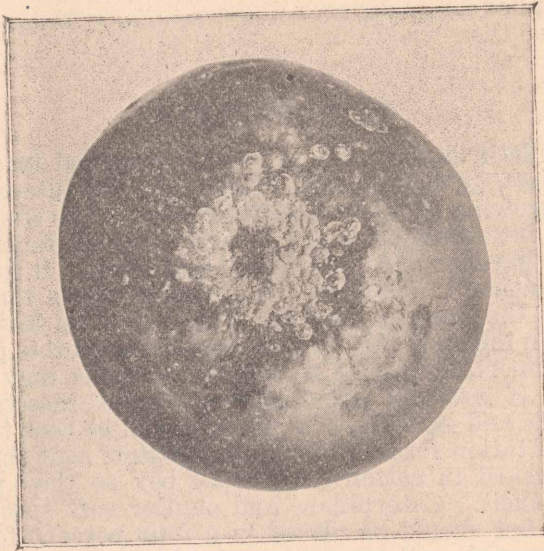
### SAN JOSE SCALE

(*Aspidiotus perniciosus*, Comstock.)

The first appearance of this scale in Idaho is not definitely known. Dr. J. M. Aldrich reported its appearance in Lewiston, in 1894. About the same year, Mr. S. S. Foote, of Middleton, reported that his orchard was badly infested with it. This scale is supposed to have come to us from Walla Walla, Washington, for a nursery at that place known to be affected, sold many trees in this state at an early date. At the present time, it is generally prevalent thruout the state with the exception of the extreme northern and eastern parts.

On trees slightly infested with it, this scale may be overlooked by most fruit growers on account of its small size and dark gray, dusty color. In large numbers on the trees, it can be readily recognized. The scale is nipple-shaped and when closely examined, shows a lemon-yellow apex. By scraping a twig with the thumb nail, the scales can be disclosed and then the flat oval bodies of the yellow insects become visible. When limbs and twigs become entirely encrusted with the scale, it may be found on the leaves also. When the scale settles on the fruit, it is generally found at the stem or calyx end. A discoloration is made

on the fruit around each scale, this being more pronounced on yellow and less so on highly colored fruit.



*Fig. 1. San Jose Scale On Apple.*  
(*Georgia State Board of Entomology, Bulletin No. 38.*)

The San Jose scale passes the winter in an immature condition on the trunk and branches. In early spring, the insects feed on the tree's sap and soon the small, two-winged, active males issue from their scales. After mating with the females, the males die. The females continue to grow and in about a month begin to produce living young. The young insects are active for a few hours but they soon settle and push their slender beaks into the bark of the tree and then begin to suck the sap. About twenty-four to twenty-six days after birth the adult males emerge and fertilize the females, which produce young about thirty-three to forty-five days after birth. It is estimated by the best authorities that the progeny from one mother during the season may number 1,608,940,000. In the light of this information, it is very easy for us to understand why stringent measures are necessary in controlling this pest.

In many sections of the state, some kinds of the forest underbrush, as well as many species of trees and shrubs, along the streams and irrigation ditches, have become infested, making it very difficult to eradicate the source of infestation from our orchards.

**CONTROL:** So many different spray materials on the market are recommended for the control of this pest that many of the orchardists are confused as to the best materials to apply. The Idaho Station is conducting some experiments along this line at

Lewiston, in the endeavor to obtain some reliable data on this subject. According to results of our last year's work, the Scale-side oil spray gave the highest percentage of efficiency. Lime-sulfur applied at 5 degrees Baume was second. The crude-oil sprays used there and in other places in the State by growers have not given satisfactory results, and are now being given up by many who have been using them in the past. There is a new oil spray which is recommended very highly by many growers, called the Dormant Soluble Oil.

Spray for San Jose scale when the buds begin to swell. It is impossible to control this scale with weak summer sprays for the insects are born continuously during the summer and the weak dilution will not kill the mother scales under their thick coverings.

The Scalecide Oil and Dormant Soluble Oil which have proved to be satisfactory in our experiments, or in the experience of others, are expensive, but they will be found most effective sprays even when the trees are heavily encrusted. In using oil sprays, care should be taken not to make them stronger than recommended. The oils must be thoroly emulsified or the free oil may cause injury to the trees. Cover the tree thoroly with oil sprays but do not apply after they collect at the base of the tree in puddles, for trees may be injured or even killed by an excessive amount of oil.

Probably no spray is more widely used against San Jose scale than is lime-sulfur. If this spray is used it is essential to test each tank before spraying. Unsatisfactory reports often come from fruit growers who have used too weak a lime-sulfur solution. Apply the early spring spray at 5 degrees Baume. The table for dilution will be found on Page 28 of this bulletin.

### OYSTER SHELL BARK LOUSE

(*Lepidosaphes ulmi* Linnaeus.)

This is a common scale insect of Idaho; it occurs in every fruit-growing section of the state but will seldom be found on the fruit unless the trees are badly infested.

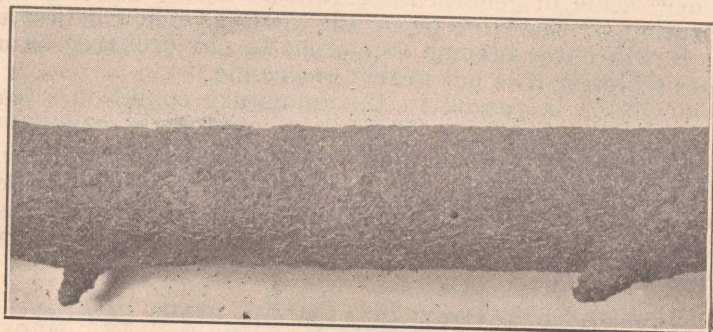


Fig. 2. Oyster Shell Bark Louse.  
(Original Photograph.)

The winter is passed in the egg stage under the scale or covering of the females. These eggs hatch between the last of May and the middle of June, the actual time depending on the weather conditions. Upon hatching, the young crawl out on the twigs and branches, insert their long thread-like sucking tubes, secrete a cottony covering, and the females never move from that spot. The males develop, fertilize the females, and die. The female, upon becoming full grown, deposits her eggs under the scale or covering of the body, the number of eggs deposited by an individual often varying from 20 to 100.

CONTROL: Spray when the young are hatching with Black Leaf 40, Summer-strength Lime-sulfur, or Miscible Oil. Spray two or three times, about a week apart, when the young first appear.

### SCURFY SCALE

(*Chionaspis furfura* Fitch)

This species of scale is represented in the state, tho little damage has been reported from it.

The female scale is irregular and pear shaped, a dusty white in color, and about one-sixteenth of an inch long. The male scales are much smaller, white in color, with nearly parallel sides. The winter is passed in the egg stage. This scale should not be confused with Oyster Shell scale. Its eggs are red in color, whereas those of the latter are white. This species of scale deposits about the same number of eggs as the Oyster Shell scale.

The young appear about the last of May or the first part of June.

CONTROL: The same as for Oyster Shell Bark Louse.

### EUROPEAN FRUIT SCALE

(*Aspidiotus ostreaeformis* Curtis)

This scale insect closely resembles the San Jose scale and the Cherry scale in general appearance. It, however, causes no discoloration of the bark or of the fruit as made by San Jose scale. It will never become dangerous to our orchards as is the San Jose scale for it is not nearly so prolific.

The winter is passed in the immature condition. Growth is completed in the spring. The full-grown female scale is nearly circular, dark gray in color and, by its orange-colored apex, may be distinguished from the San Jose scale whose apex, it will be remembered, is lemon-yellow.

CONTROL: The control methods are the same as used for San Jose scale.

### COTTONY MAPLE SCALE OR VINE SCALE

(*Pulvinaria vitis* Linnaeus.)

The females pass the winter as flat, oblong, yellow or dark-

brown insects. In the spring, they secrete at the posterior end, a white cottony mass through which the eggs are distributed. The scales are about one-fourth of an inch long. The eggs are deposited in the egg-sac in May or June. They soon hatch and the young crawl out and settle on the leaves and small twigs. The males mate with the females in the fall and die. The females migrate to the twigs on which they pass the winter.

CONTROL: Spray two or three times about a week apart when the young first appear. Use Black Leaf 40 or Kerosene Emulsion.

### EUROPEAN FRUIT LECANIUM

(*Lecanium corni* Bouche.)

This scale is becoming quite common in this state, occurring in both the northern and southern parts, and a few orchards have been almost entirely destroyed by it.

The Lecanium scales are known as soft scales. The winter is passed as young, oval, flat, brown scales on the bark of the tree, mostly on the smaller branches. In the spring, they continue their growth; the adult females are about one-eighth of an inch long, are almost as wide, and about as high as they are long. The female deposits white eggs which completely fill the cavity of the scale previously occupied by her body. The young soon hatch and crawl out on the leaves, establishing themselves along the veins. Before the leaves fall, the young seek winter quarters on the limbs and twigs.

CONTROL: Scalecide or Lime-sulfur at 5 degrees Baume, used as a dormant spray, may kill a large percentage. Black Leaf 40 or Kerosene Emulsion, applied at intervals of a week apart when the young appear, should give good results.

### CODLING MOTH

(*Carpocapsa pomonella* Linn.)

There is no insect pest in the state of Idaho that is more destructive or that costs the growers more money than does the codling moth. It will be necessary in this bulletin to relate some facts regarding this pest that may be well known to many of the growers.

The codling moth passes the winter as a larva (worm) enclosed in a cocoon or case. The cocoons may be found concealed under loose bark of the tree, under leaves or rubbish, and sometimes in the packing-houses and other sheltered places. In the spring, about the time the apples bloom, the larva changes to a pupa and remains in concealment. The time spent in the pupal stage depends largely upon the weather, but probably averages about twenty-five days for the spring brood. The author has found many growers who believe that at the time the first spray is applied, the codling moth larva is in the calyx end of the apple,

but at that time the insect is hidden away as a larva in the cocoon or has changed to the pupal or resting stage.

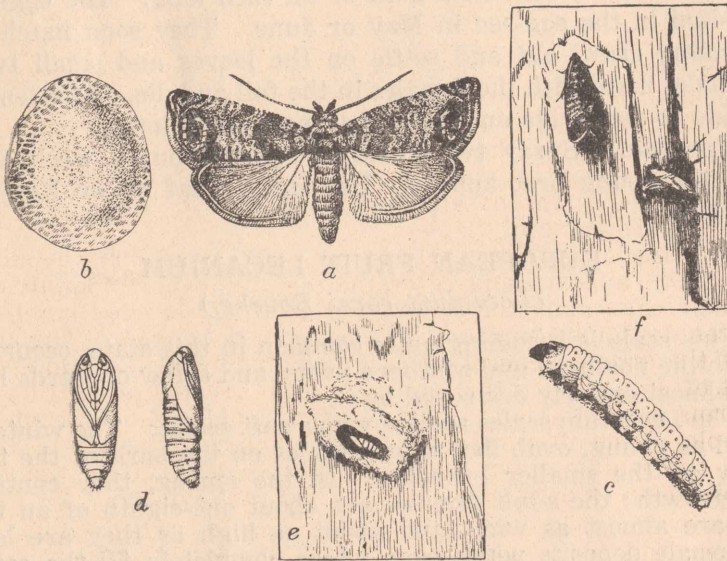


Fig. 3. Codling Moth.

(a) Adult, slightly enlarged; (b) egg, greatly enlarged; (c) larva, slightly enlarged; (d) pupa, slightly enlarged; (e) pupa in its cocoon, reduced about one-half; (f) moth and empty pupa shell, about natural size. (From *Farmers' Bulletin No. 171, Division of Entomology, by C. B. Simpson.*)

The moths begin to emerge about two weeks after the petals fall and continue to emerge for a period of several weeks. The moth is very small, measuring about three-fourth of an inch across the expanded wings, though it generally appears much smaller as it is generally seen while resting with wings folded. The moth is ashen gray in color, with wavy bands across the front wings. The ends of the wings are brown.

A few days after emerging the moths begin to deposit their eggs. (Look for eggs about three weeks after the petals have fallen.) The first eggs are usually deposited upon the leaves. It was erroneously thought for a number of years that the moth deposited her eggs in the calyx cup of the apple. Each moth deposits about fifty eggs. The eggs are almost transparent when first deposited. They are flat, slightly oval, and a little smaller than the head of a pin. The egg laying extends over a period of several weeks.

As soon as the young worms hatch they crawl down the stem of the leaf and seek the nearest apple. Seventy-five to ninety percent of the first brood worms enter the calyx end of the apple and



it is for these worms that the first or calyx spray is applied. The first spray kills none of the ten to twenty-five per cent that enter thru the side of the apple. For these worms, a spray is applied about three weeks after the petals fall to give the apple a thoro coating of poison. If this spray is washed off by rains, or in orchards very badly infested with this pest, it may be necessary to apply another a few weeks after the second.

The worm remains in the fruit from fifteen to twenty-five days. It then leaves the apple and finds a suitable place for spinning the cocoon in which it pupates. The full grown larva is about three-fourths of an inch long, pinkish white in color with a dark brown head.

After spending from ten to twenty days as a pupa, the adult codling moth appears and after mating, the females again deposit their eggs upon the leaves and fruit. The eggs hatch in five to ten days and the young worms enter the apples. The first eggs of the second generation can be found from the middle to the last of July. With this brood, a much greater proportion of the worms enter the side of the apples, usually entering where two apples come in contact with each other, or where a leaf touches the fruit. After the worms leave the fruit in the fall they spin their cocoons in which they pass the winter.

**CONTROL:** Begin to apply the first spray when eighty to ninety per cent of the petals have fallen, or begin in time to complete the first spray before the calyx lobes have closed. Two hundred pound pressure, if possible, should be used to drive the spray into the calyx cup. It may be necessary to spray at different times for different varieties. Use two pounds of paste, or one pound powdered arsenate of lead, to fifty gallons of water.

The second spray should be applied about three weeks after the first. Look for codling moth eggs at this time and spray when you find the first eggs. It may be necessary to spray again in two or three weeks if the apples are not thoroly coated with spray material or if the orchard is a seriously infested one. This will depend upon the infestation.

To determine the time for the regular third spraying, band the trees about the middle of June and spray twenty days after the first larvae come down under the bands. The third spraying should usually be applied about the middle of July in southern Idaho and the first of August in northern Idaho.

The number of applications will depend on the infestation the previous year, the variety of fruit, the infestation in neighboring orchards, effectiveness of early sprays, the amount of rainfall, and other seasonable conditions. However, the early calyx spray is the most important and if this and the other early brood sprays are neglected or improperly applied when the worms are bad, no amount of spraying late in the season will save the crop.

## THE FRUIT TREE LEAF ROLLER

*(Archips argyrospila Walker.)*

Tho reported as common thruout the United States, the fruit tree leaf-roller has only recently made its appearance in Idaho and little damage has been done by it to our fruit trees up to the present time.

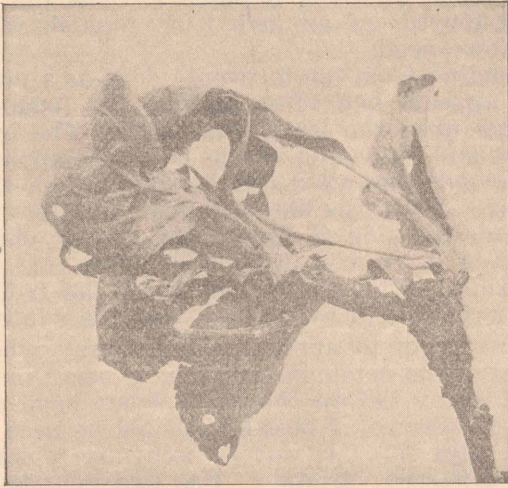


Fig. 4. Leaves tied together by larva of fruit tree leaf roller.  
(From Herrick)

In this state the eggs are laid in June and July. They are deposited in small, oval, flat patches, each patch containing about 150 eggs, sealed over by a gummy substance which protects them during the winter. The eggs hatch the following April or May and the young larvae enter the opening buds or crawl upon the expanded leaves. They spin a loose web which fastens the leaf together and forms a nest in which they feed. Later the nest may be extended, including some of the fruit into which the larvae may eat irregular holes. The larvae continue to feed for two or three weeks, attaining a length of about three-fourths of an inch. They are green in color with a dark brown head and thoracic shield. When the larvae are full grown, they pupate in a nest made of leaves and a silken web. About ten days are spent in the pupal stage.

The moths are about the size of the codling moth, measuring about three-fourths of an inch across the expanded wings. The wings are brown in color with irregular bands and spots of yellow. They will usually be seen in a resting position with the wings folded.

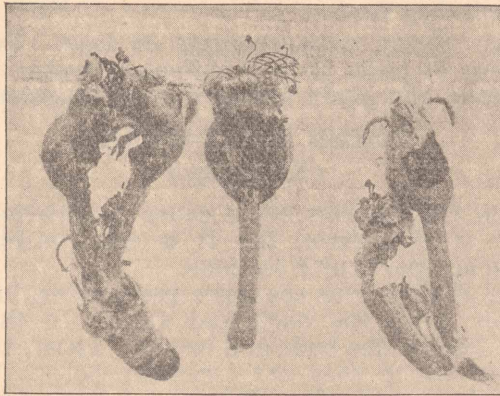


Fig. 5. Work of fruit tree leaf roller larvae on apples.  
(From Herrick)

**CONTROL:** Ordinary spraying with arsenate of lead, the same strength as used for the codling moth, should control the leaf-roller, but one and one-half pounds of powdered arsenate of lead or three pounds of paste will insure satisfactory results. It must be said, however, that in bad cases it is a rather difficult pest to handle with arsenicals and must be vigorously treated and the application should be made while the worms are still very small. Make the first arsenical application when the leaf buds begin to open and a second about two weeks later. The first spray for codling moth will also be of value as a third spray for leaf roller. Colorado reports good results from using miscible oil or kerosene emulsion as a dormant spray for killing the eggs.

#### THE BUD-MOTH OR LEAF CRUMPLER (*Tmetocera ocellana* Schiff)

The bud-moth was first reported in Idaho by Dr. J. M. Aldrich in 1896, though he reported little damage being done by it at that time. The moth has spread considerably since that date, but is not yet considered a serious pest in the state.

The bud-moth passes the winter as a half-grown larva in silken webs on the twigs. When the buds begin to open in the spring, the larvae leave their winter quarters and enter the buds, feeding on both the leaf and flower buds. Later they feed on the larger leaves, often fastening together several leaves in which they live, coming out only to secure food. Partly-eaten leaves often turn brown. The larva is about one-half an inch long, brown in color with a black head and thoracic shield. The larva continues its work of destruction until grown, when it changes to the pupal stage in a nest of leaves and silk.

The moths emerge in June and July and deposit their small, oval, transparent eggs on the leaves. The eggs hatch in a week or two and the young larvae begin to feed on the leaves. The fruit is sometimes attacked, when it comes in contact with the

leaves on which they feed.

CONTROL: Spray with arsenate of lead. Two pounds of powder, or four of paste to fifty gallons of water, when the leaf buds are opening and again before the tree blossoms.

### GREEN FRUIT-WORMS

(*Xylina* sp.)

The green fruit-worms often cause considerable damage in the orchards of this state, tho it is not considered to be a serious pest in any particular sections.

The green fruit-worms are large green caterpillars with light colored stripes down the back and sides. In the spring, the young worms feed on the buds and leaves. Later, they attack the young fruit in which they eat irregular holes. They may go from fruit to fruit, and often damage a large percentage of the crop. The injured portion of the fruit generally heals leaving a brown scar.

CONTROL: Spray with arsenical sprays, using the same strength recommended for the forest tent-caterpillar.

### FOREST TENT-CATERPILLAR

(*Malacosma disstria* Hubner)

The forest tent-caterpillar is very common in the state of Idaho and is probably found in every section. As the name implies, it is a forest pest and more common along the roadsides in many parts of the state than in our orchards, though considerable damage is often done to our trees by this caterpillar.

The winter is passed in the egg stage. The eggs are laid in masses, containing from 150 to 300 eggs. They are deposited in a band around the twigs and covered over with a gummy substance. They hatch in the early spring and the young caterpillars begin at once to feed on the leaves. This species feeds in a colony but does not make a web or tent. They congregate for molting and their cast skins may be found in masses hanging from the branches or trunk of the tree. When full-grown, the caterpillar is about two inches long and is easily distinguished by the row of key-hole shaped, cream colored spots down the middle of the back. They become full grown in June or July and spin cocoons of white silk in the curled leaves or on the twigs. In about two weeks, the moths emerge and lay their eggs. The moths are dull red in color with brown bands across the front wings. They measure about one and one-half inches across the expanded wings.

CONTROL: Spray with arsenate of lead when larvae appear, using three pounds of paste, or one and one-half of powder, to fifty gallons of water.

### THE WESTERN TENT-CATERPILLAR

(*Malacosoma phuiialis* Dyar)

Though common thruout the state, this species is not found

abundantly in any particular section of Idaho. It is correctly named a tent-caterpillar, for the larvae house themselves in a silken nest or tent.

The winter is passed in the egg stage, the eggs resembling those of the forest tent-caterpillar except that they do not usually encircle the twig. The eggs hatch in early spring about the time the buds open and the young larvae begin to feed on the opening leaves. The young caterpillars remain together and soon build the silken nest in which they shelter themselves when not feeding. The full-grown caterpillars are about two inches long, with a broken bluish line down their backs on all but the first few and last three segments. Along each side is a yellow line running from end to end. The body is covered with long yellow hairs. Toward the middle of summer and sometimes later, the larvae become full grown and crawl away to protected places to spin their cocoons. About two weeks are spent as pupae. The adult moths emerge and soon deposit their eggs. The moths measure about one and one-half inches across the expanded wings. They are light brown in color with white, irregular bands on the front wings.

CONTROL: They can be controlled in the same way as the forest tent-caterpillar and they may also be destroyed in the nests by burning.

### THE RED HUMPED CATERPILLAR

(*Schizura concinna* Smith and Abbot)

This insect will be found in midsummer, feeding upon the ends of the branches. It will usually be found in colonies, but it is not uncommon to find it feeding singly.

The larva will be readily recognized by the coral-red head and the prominent red hump on the fourth segment. The body of the caterpillar is striped with yellowish white lines and dark brown lines. The back is marked with five narrow black lines and a double row of spines. The caterpillars make their appearance in July and August. The full grown larva measures about one and one-half inches. Before transforming to the pupa, the caterpillars descend to the ground and find shelter under leaves and rubbish. Here they spin a silken cocoon in which they pass the winter.

In Idaho the moths appear in June and July. The moth is brownish-gray in color and has a wing expanse of one and one-half inches. The female deposits her round flattened eggs on the under side of the leaf.

CONTROL: Same as for the forest tent-caterpillar.

### THE YELLOW-NECKED CATERPILLAR

(*Datana ministra*. Drury.)

This species is not common in the state of Idaho, but specimens from various parts of the state have been received at the

Experiment Station from time to time.

The adult caterpillar is about two inches long, with a black head. The segment next to the head is a bright orange-yellow, from which the insect is named. On either side of the body there are three black stripes alternating with four of yellow. This species can be quickly identified when found in the orchards because it holds head and posterior segments erect, jerking vigorously, when distributed.

CONTROL: Arsenical sprays will destroy these caterpillars but as a rule they will not appear in numbers sufficient to do any great damage.

### THE CHERRY-TREE TORTRIX

(*Archips cerasivorana*. Fitch)

Though common in the state, this species is seldom found in our orchards, but will be noticed more often on wild cherries along the fence-rows and roadsides.

The winter is passed in the egg stage. The eggs are deposited in flattened masses on the host plant. They are sealed over by a gummy substance which serves as a protection during the winter. The young hatch in June or July and begin at once to feed and spin a silken nest which usually encloses a large number of leaves. The larvae, when full grown, are about five-eighths of an inch long and yellow in color. The larvae pupate on the outside of the nests and the pupal cases may be seen hanging to the nest, after the moths have emerged.

CONTROL: Probably the only method that need be employed is to cut out the webs and burn them.

### FALL WEB-WORM

(*Hyphantria cunea* Drury)

In late summer the young hairy caterpillars will be found feeding on the leaves which they inclose in a silken web. The caterpillars extend the web over the branch, making a loose unsightly mass. When the food supply of one limb is exhausted, the caterpillars migrate to a fresh branch and form a new web. In the fall they leave the nest and pupate under rubbish or in crevices of the bark. The moths emerge the following June or July and deposit their eggs in clusters upon the leaves.

CONTROL: Remove the nests when small or spray with arsenate of lead when caterpillars appear.

### THE ANTIQUE TUSSOCK-MOTH

(*Nototophus antiqua* Linn)

This species is known to occur in both northern and southern Idaho. Some growers report serious damage done by it.

The winter is passed in the egg stage. The eggs are deposited in large numbers on the cocoons. Often a number of leaves are fastened to the cocoons, making the egg masses very conspicuous during the winter. The caterpillars hatch in the

spring. The young caterpillars are hairy with two black tufts of hair on the back; later these tufts turn white.

**CONTROL:** The egg masses may be pruned out during winter or early spring. Spray with arsenical sprays as recommended for the forest tent-caterpillar. Apply spray when the caterpillars first appear.

### THE PEAR AND CHERRY SLUG

(*Caliroa cerosi*. Linn.)

This is a common insect pest of the pear and cherry, and is sometimes found on the plum and other fruit trees. It is called a slug because of the slimy exudation which surrounds the larva.

Immediately upon hatching, the larvae begin to feed on the upper surface of the leaf; if a number of slugs work on the same leaf the entire surface may be removed, leaving nothing but a skeleton of veins.

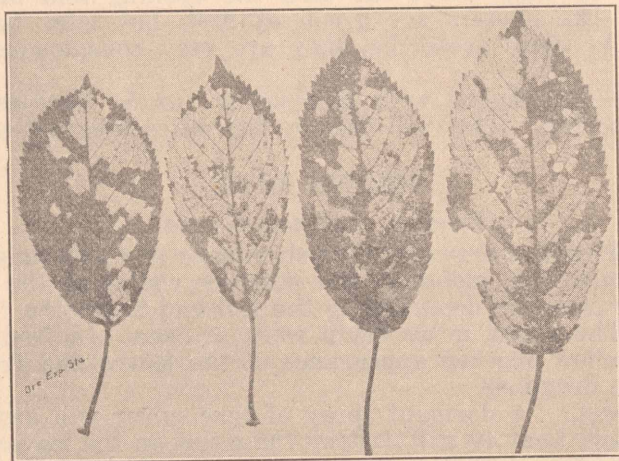


Fig. 6. Cherry tree injured by slugs.

(*Biennial Crop Pest and Horticultural Report 1911-12, Oregon Agricultural College.*)

The larvae are said to molt five times. After the fifth molt, they drop to the ground and work their way into the soil. There are two broods a year and when the last brood larvae drop to the ground, they remain as pupae until the following spring.

The adult pear slug emerges in the spring. It is a black bee with four dusky wings and is known as a saw-fly on account of the saw-like ovipositors which the insect uses to cut the surface of the leaf in which to deposit the eggs.

**CONTROL:** The Oregon Agricultural College has obtained the best results by using Hellebore, one pound to fifty gallons of water. Arsenate of lead can also be used but it should be applied either before the eggs hatch or at least when the slugs are still

very small. Many cherry growers delay the arsenical spray until too late. As a result, the cherries are so nearly ripened that it is often objectionable to coat them with the white arsenate spray. The leaves should, therefore, be well coated with poison long before the cherries start to ripen. As winter is spent in the soil, the pupae may be destroyed by early spring cultivation.

#### PEAR-LEAF BLISTER MITE

(*Eriophyes pyri*. Pagenstecher.)

The under surface of the leaves of pear and sometimes of apple trees are often disfigured by greenish blisters which later turn brown or black. These spots are caused by a small mite which can not be seen without the aid of a hand lens.

The adult mites pass the winter in the buds. In the spring when the buds open, they migrate to the leaves and burrow beneath the epidermis, causing the formation of a small blister at the point of entrance. Eggs are deposited in the leaf and when the young are matured they crawl out thru the opening and make new blisters. The blisters are green at first, but later turn dark brown. As these areas die, they are very conspicuous on the leaves.

CONTROL: Spray with lime-sulfur of 5 degrees Baume early in spring. This will destroy the mites hibernating in the buds.

#### BROWN MITE

(*Bryobia pratensis* German)

The mites are brown or reddish in color and very small. The eggs are also red, globular, and scarcely visible to the unaided eye. The eggs are deposited in the fall and hatch the following spring. The young mites begin work at once. In feeding they cause a yellow specked appearance of the leaves and frequently premature dropping.

CONTROL: A dormant spray of lime-sulfur will destroy the eggs. Black Leaf 40 will destroy the mites on the leaves. Colorado Agricultural College has reported good results in killing mites by using ten pounds of sulfur to fifty gallons of water.

#### THE RED SPIDER

(*Tetranychus bimaculatus*. Harvey.)

This mite is known to occur in various parts of the state and considerable damage is done by it. According to George P. Weldon of Colorado Experiment Station, this species hibernates in the soil as an adult, close to the trees upon which it has been feeding. The eggs are laid in the spring by the mites that live thru the winter. The eggs are pearly white and may be found on the under surface of the leaves. The red spider spins a web and these webs may be found on infested trees. Injured leaves have a yellow mottled appearance.

CONTROL: The mites may be destroyed by sulfur sprays. Apply as directed for brown mite.



## APHIDS

The green apple aphid (*A. pomi*) passes the winter in the egg stage. About the time the buds open in the spring, the eggs hatch into wingless female lice which produce young without fertilization. This generation produces both winged and wingless aphids. The winged form spread to other parts of the tree or to neighboring trees and multiply rapidly during the summer. Green aphids feed upon the under side of the leaves causing them to curl. This species causes most serious damage to young trees.

The rosy apple aphid (*A. sorbi*) has much the same life history as that of the green apple aphid. The insects feed on the under surface of leaves causing them to curl. They do considerable damage to old trees in this state, often causing the leaves to turn yellow. They also attack the fruit, making irregular or "pimpley apples."

According to E. P. Taylor, Field Horticulturist, the grain aphid (*S. avenae*) has not caused any noticeable damage to the fruit trees of Idaho up to the present time. He also states that the clover aphid (*A. bakeri*) attacks, to a small degree only, the apple foliage.

The green plum aphid (*A. pruni*), the black cherry aphid (*M. cerasi*) and the green peach aphid (*M. persicae*) are all common species of aphids found in Idaho. They feed upon the leaves of their host plants causing them to curl.

**CONTROL:** Often aphids will be held in check by the lady beetles which feed both on the larval and adult stages. The lacewing fly is also a valuable insect. The eggs of this fly should never be destroyed when found. The eggs look like small green knobs on the end of long hairs. After hatching, these eggs turn white. A third important beneficial insect is the syrphus fly whose larva feeds upon aphids.

A late spring spray of lime-sulfur at 5 degrees Baume will give beneficial results against aphids, but supplementary sprays are necessary. Black Leaf 40, 1 quart to 200 gallons of water, has given good results. After the lice have curled the leaves, it is almost impossible to reach them with any spray material. Kerosene emulsion and tobacco solutions are as effective summer sprays against aphids as any application that can be used at that season.

The most injurious and widely distributed orchard aphid of the many we have is the one that follows the woolly aphid.

## WOOLLY APPLE APHIS

(*Schizoneura lanigera*. Haus.)

The woolly aphid is a very destructive pest in some of the orchards of Idaho. Its presence will probably first be made noticeable by cottony masses on the small twigs and wound around on the trunk and limbs. Most plant lice feed on the leaves; this species confines its attacks to the bark of limbs, trunk

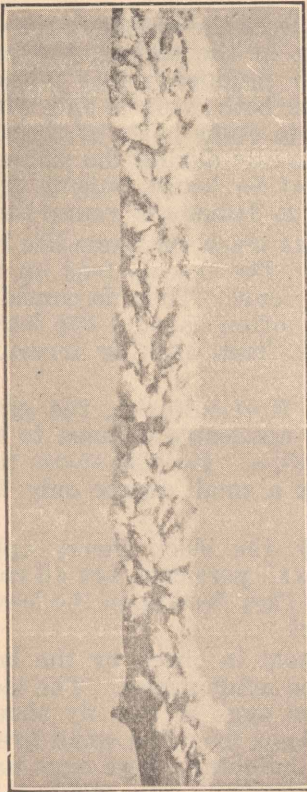


Fig. 7. Woolly Apple Aphis.

(*Seventh Annual Report, State Entomologist of Indiana*)

After the buds open in the spring, the aphids from the trunk migrate to the tender bark of the twigs and limbs. Aphids of the root form may migrate to that part of the tree above ground. The females soon begin to produce living young. Multiplication is rapid and soon large cottony patches of aphids may be found on the twigs and old wounds. During the summer, only the wingless females occur on the apple trees. They continue to give birth to living young with fertilization, a large number of generations being developed during the summer.

**CONTROL:** Often woolly aphids will be held in check by lady-beetles, syrphus flies and lace-wing larvae. In spraying for this species of aphid, sufficient force must be maintained to wet ~~the~~ the woolly covering. The same sprays may be used for this species as recommended for other aphids. In badly infested bear-

and roots. Upon old trees, the damage is usually slight, young trees being more seriously affected.

The woolly aphid has a very complex life cycle. C. P. Gillette and E. P. Taylor (in Bulletin 133, Colorado Experiment Station) state there are four means of starting the summer infestation. "The little brown lice that descend mostly to the crowns of the trees in the fall to spend the winter; lice from the roots whose ancestors lived upon the roots the previous summer; young lice of the last fall brood that were able to withstand the rigors of the winter upon the trunk and branches; and lice hatching from eggs that were deposited the previous fall by the sexual females.

ing apple orchards, a miscible oil spray applied in the fall after the fruit is harvested is a practical and effective means.

### FLAT-HEADED APPLE TREE BORER

(*Chrysobothris femorata*. Fab.)

This insect causes little damage in the state of Idaho, except in a few localities. The injury may first be detected by the discolored bark near the surface of the ground covering the tunnel made by the borer. The injury is principally upon young trees. The name flat-headed borer is very descriptive of this pest, for the larva is a long flat round-headed worm. The worms burrow in the tender wood under the bark during the summer. In the fall they burrow in the older wood of the tree, pupate and remain in the tree until the following spring. In the spring they emerge as beetles and the females deposit their eggs on the bark of the tree near the ground.

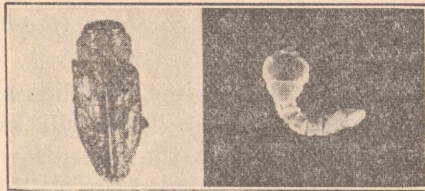


Fig. 8. Flat-Headed Borer, Larva and Adult.  
(Seventh Annual Report, State Entomologist of Indiana.)

**CONTROL:** Place building paper around the trunk of the trees to prevent the borers from depositing their eggs on the trunk. Do not use tarred paper as cases have been noted where the tar has injured the bark. Insert lower end beneath the surface of soil to prevent their entering from below. Do not use cord too heavy for the tree to break as it expands. In some cases it may be practical to dig out the borers with a knife, or to paint the tree with a poison mash.

### THE PEACH-TWIG BORER

(*Anarsia lineatella*. Zeller)

The peach-twig borer is a very destructive pest in sections of Idaho, causing considerable damage to the peach crop.

The young larvae pass the winter under the bark usually at the forks of the branches. Their presence may be detected by very close inspection which will reveal small tubes made of pieces of bark and silk. The young larvae emerge in the spring and begin feeding on the new growth as soon as the buds open. Often they bore directly down the center of the twigs, causing the twigs to die. Later the larvae may enter the fruit, causing gummy wormy peaches. There are several generations during the year. The last brood of larvae enter the twigs and pass the winter under the bark.

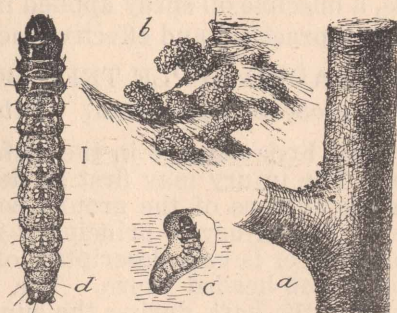


Fig. 9. Peach-Twig Borer.

(a) twig of peach, showing in crotch minute masses of chewed bark above larva chambers; (b) latter much enlarged; (c) larval cell, with larva; young larva much enlarged. (From *Farmers' Bulletin No. 80, U. S. Department of Agriculture, Division of Entomology.*)

**CONTROL:** Spray about the time the buds are swelling with lime-sulfur at 5 degrees Baume. This will kill many of the hibernating larvae. Spray about the time the petals fall with arsenate of lead, same strength as used for codling moth.

### PEACH-TREE BORER

(*Sanninoidea opalescens. Edwards*) or (*S. exitiosa. Say.*)

The moths deposit their eggs in midsummer on the trunk of the tree just above the surface of the ground. The young larvae enter the bark and work up or down in the sapwood. They make no well-defined burrow as they feed and often several borers will be found working in the same tunnel. The winter is passed as larvae in the trunk or roots. In the spring they crawl out near the surface and pupate.

This species generally work in peach and prune trees, but according to the Oregon Experiment Station, they may be found in apricot, apple and cherry trees.

**CONTROL:** Paint the trunk of trees with poison wash, then wrap with building paper. It may also be found necessary to dig out borers with a knife.

### THE SNOWY TREE-CRICKET

(*Oecanthus niveus De Geer.*)

This species has been reported as doing serious damage to some of the prune orchards of southern Idaho. They have never been reported as doing damage to apple trees of this state. B. B. Fulton, of the Geneva Experiment Station, says: "This species is a tree and bush-inhabiting form. It is found most abundant in apple orchards and is more or less common in plantings of other fruit trees and in raspberry plantations." Mr. Fulton claims that

in orchards regularly sprayed with arsenical sprays the crickets do not become very abundant.

The eggs are deposited under the bark of the host plant in late summer. The following spring the eggs hatch and the young crickets feed on the leaves. The adults often eat small round holes in the fruit, and damage it also in the form of punctures made by the female in depositing her eggs.

CONTROL: No satisfactory remedy has ever been reported. Slingerland claims that injury from the tree-cricket is rarely found in orchards kept free from rank vegetation. Arsenical sprays will aid in controlling this species.

### CICADA

(*Cicada tibicen*)

The Cicada is probably familiar to almost every person, though few recognize its work on trees when they see it. The song of the cicada is a high sharp trill and we often hear it singing as we pass thru the orchards or along the roads in midsummer.

The cicada that is found in our state is black in color and measures about two inches across the expanded wings. It injures trees by making punctures on the twigs and limbs. The female, in depositing her eggs, tears up the bark and soft wood, leaving an excellent entrance for fungus diseases and other insects. The twigs are often broken because of their weakened condition. Orchards located near bodies of timber are generally the worst affected.

CONTROL: Prune out infected twigs. Spraying is of little or no value.

### BUFFALO TREE-HOPPER

(*Ceresa bubalus*. Fab.)

This insect is a common one in southern Idaho and recently has caused alarm in parts of northern Idaho. It is most noticeable upon young trees.

The full-grown insect is green in color and triangular in shape. The injury is in the form of two parallel cuts on the twigs and small limbs made by the insect for the purpose of depositing eggs. The incisions are made by the ovipositor and by cutting across the wound with a knife, the two rows of eggs can be found. The wounds often make harboring places for other insects and sometimes weaken the twigs so they may be broken off by the wind.

CONTROL: Prune out and burn twigs containing eggs, and by all means practice clean cultivation while the trees are young. Young trees growing in strawberry beds, and along weedy ditch banks and fence corners are often badly damaged.

## APPLE LEAF-HOPPER

*(Empoasca mali. Le Baron.)*

The leaf-hopper is very common in this state, though little damage is noticed as a result of its work. This species feeds on a great many different plants, puncturing the tissue, sucking the juice, and giving the leaves a silvered, mottled appearance. The leaf-hoppers are greenish white in color, very active and when disturbed the adults will jump quickly and fly about the plant on which they were feeding.

CONTROL: The leaf-hoppers can best be reached when they are young and the twigs are undeveloped. Use Kerosene emulsion or Black Leaf 40.

## Garden Pests

### COLORADO POTATO-BEETLE

(*Leptinotarsa decemlineata*. Say.)

In northern Idaho the potato beetle is by far the worst garden pest and often the potato vines become entirely stripped of their leaves. This pest has not yet made its appearance in south Idaho and the potato growers there should do all in their power to prevent it from getting a foothold in that part of the state.

In the fall the beetles enter the earth and hibernate until the warm sunshine of spring brings them out. It is not uncommon to find them in the fields several weeks before the potatoes are up. As soon as the young plants appear, the beetles begin to feed on the leaves. They also deposit their yellow eggs in clusters upon the under sides of the leaves. These eggs hatch in about a week and the young larvae begin at once to eat the leaves. The young larvae are dark red in color, with black spots on each side. They gradually get lighter in color as they grow. The larvae gorge themselves with potato foliage, a few of them often stripping a plant of all its leaves. They feed two or three weeks, then drop to the earth, enter the soil and pupate. In ten or twelve days the adult beetles emerge and begin to feed on the vines and deposit eggs for a second generation. If the food is scarce, the beetles will migrate to neighboring fields. There are two generations a year in North Idaho.

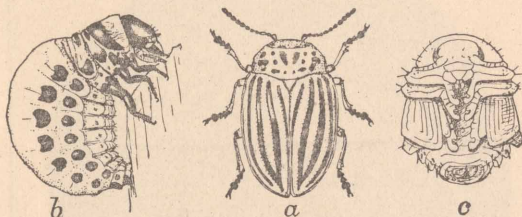


Fig. 10. Colorado Potato Beetle.

(a) beetle; (b) larva; (c) pupa. (After Chittenden, U. S. Dept. of Agr.)

**CONTROL:** Early spring spraying as soon as the vines are up is very essential in controlling the potato beetle. Hand picking, if employed early in the season, is of great value, but where large areas are planted, other methods are necessary. Spraying the vines with arsenate of lead and Paris green has given excellent results. Directions for preparing these sprays will be found at the end of this bulletin.

### POTATO FLEA-BEETLES

(*Epitrix cucumeris*. Harris.)

There are several species of flea beetles found in the gardens

of Idaho, but, unless found in large numbers, they never cause any serious damage. They are small black beetles, very active and have the power to jump a considerable distance. They are common in this state on potatoes, cabbage and tomatoes. They eat small holes in the leaves often causing the plants to wilt.

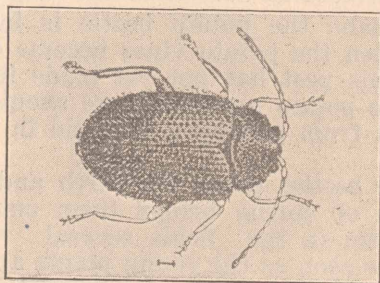


Fig. 11. *Potato Flea Beetle*  
(After Chittenden, U. S. Dept. of Agr.)

The adult beetles pass the winter under leaves and rubbish. In the spring, they come out and deposit their eggs on the roots of weeds. The young larvae feed on the roots of the weeds. The beetles come forth and attack the foliage of our garden crops. There are two or three generations a year.

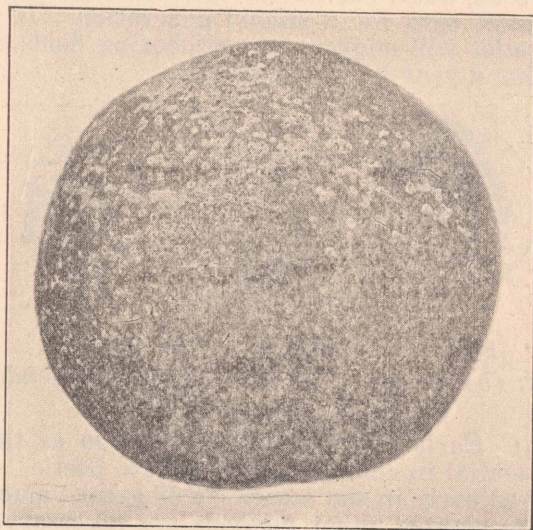


Fig. 12. *Flea Beetle injury on tomato.*  
(Seventh annual report, State Entomologist of Indiana.)

CONTROL: Spray with arsenate of lead or Paris green. Either may be used with weak Bordeaux Mixture which acts as a repellent. Dust sprays are also recommended. Make sprays as recommended and spray when the beetles first make their appearance.



## CABBAGE WORMS

(*Pontia rapae*. Linn.)

This is probably the worst cabbage pest in the state. The adult is a white butterfly; the female has two black spots on the fore-wings, while the male has only one, but both sexes have one black spot on the hind-wings. The worms are probably well known to all gardeners.

The winter is passed as pupae among the rubbish in the garden. In the spring, the butterflies emerge and deposit their small, yellow, oval eggs. The eggs hatch in a few days. The larvae begin to feed at once and eat large holes in the cabbage leaves. The worms feed about two weeks, then pupate. The pupal case is green at first and resembles a snail in appearance; later it turns brown. There are two or three generations a year in this state.

**CONTROL:** At the close of the season, all cabbage should be removed from the field or destroyed. Arsenical poisons have given good results. Use one-half pound powdered arsenate of lead, or one pound of paste to twenty-five gallons of water. Soap added to the spray will make it stick better. Paris green may be mixed with flour, using one teaspoonful of Paris green to one pint of flour. This should be dusted on the leaves. Spray or use dust when the worms first appear. If spray is used late in the season, it will be well to strip off and destroy the outer leaves for they may contain poison.

## CABBAGE APHIS.

(*Aphis brassicae* Linn)

The cabbage-louse is usually a common pest of the garden wherever cabbage is grown, and occasionally the aphids become abundant enough to cause damage to the crop. This species may also be found on brussels-sprouts, kohl-rabi, cauliflower and closely allied plants. The cabbage louse is very prolific and a large number of generations may develop during the summer. The body of the louse seems to be covered with dry powder which serves as a protection to the body against insecticides.

**CONTROL:** Black Leaf 40 has probably given best results in spraying for cabbage aphis. Kerosene emulsion is also good. It is very important to spray with a high pressure and wash as many off as possible.

## TOMATO-WORM.

(*Phlegethontius sexta* Joh.)

In some sections of the state the tomato-worms cause considerable damage. These large green worms which attack the tomato are the same species which attack the tobacco.

The winter is passed as pupae in the soil. In late spring, the moths emerge and deposit their eggs singly upon the leaves. The larvae hatch in a few days and begin at once to feed on the foliage. When full grown the larvae are about three inches long. They drop to earth, enter the soil and pupate. There is but one generation a year in Idaho.

**CONTROL:** As a rule this worm can be controlled by hand-

picking. Spraying with arsenate of lead a little stronger than used for codling moth will give good results. Two or three sprayings may be found necessary.

### CUT WORMS

The cut worms are among the most destructive pests in our gardens. They burrow just beneath the surface of the ground when not feeding and come out in the evening and feed. They usually attack the plants at the surface of the ground, often cutting the plants entirely off. There are many different species of cut worms that are active in the gardens. Some species climb fruit trees and do considerable damage. These worms are called climbing cut worms.

The moths usually fly at night in midsummer. They are brown owlet moths so often attracted to lights. They deposit their eggs on weeds or grass. The young larvae pass the winter curled up in the soil. In the spring they come out and attack the plants.

**CONTROL:** Late fall and early spring cultivations will help hold the cut worms in check. Keep land as free from weeds as possible. Place poison bran mash in garden before seeds are planted or plants are set. Follow directions as given in back of bulletin.

### PEA-WEEVIL

(*Bruchus pisorum* Linn.)

It is not known when the pea weevil first made its appearance in Idaho, but it is known to occur in various parts of the state at the present time.

The weevil is about one-fifth of an inch long; it is black in color, but is thickly covered with short brown hairs which give it a mottled appearance. The winter is passed in the adult stage. In the spring the weevils make their appearance and lay their eggs upon the surface of the pods. Upon hatching, the young larvae eat thru the pod and enter the seed. The larvae continue to feed until full grown, pupate, change to the adult stage, but remain within the seed. In the dried peas, the presence of the weevil will be shown by a well defined circle made by the full grown larva.

**CONTROL:** Peas may be held over one season, for the weevils will not breed in dried peas. Dr. Chittenden states that if peas are heated to a temperature of 140 degrees F., the weevils will be killed without injury to the seed. Fumigation is probably the best means of destroying them in seed peas. Place pea seed in a barrel; use one ounce of carbon bisulfide to 100 pounds of peas. Pour carbon bisulfide into a pan placed on surface of peas. The top of the barrel must be tightly closed. Peas containing live weevils should never be planted.

### MELON-APHIS

(*Aphis gossypii* Glover.)

Specimens of melon aphis have been received at this station from different sections of the state and some growers report

serious damage from this species.

The aphids attack the vines, causing the leaves to curl. They sometimes become so abundant as to completely ruin the entire crop. The life history is much the same as that of most of our common aphids. Multiplication is rapid, and, as they become more numerous, winged forms migrate to other plants.

CONTROL: There are many insect enemies that feed on the melon aphid and often hold it in control. Trap crops may be planted and destroyed before the vines are up. Kerosene emulsion and Black Leaf 40 are effective sprays. The nozzle must be held under the leaves and the spray applied upward to hit the aphids on the under surface of the leaves.

#### CORN-EAR WORM (*Heliothis absoleta* Fab.)

This is a very common pest of the corn fields of Idaho. It is virtually the only insect injuring the ears of corn, and is especially destructive to sweet corn.

The winter is passed as a pupa in the soil. In the spring, the moth emerges and deposits its eggs on corn, peas, beans, or on whatever food plants are available. The later generations deposit their eggs on the corn silk. The worms feed in the young kernels at the tips of the ears, causing considerable damage.

CONTROL: No spray has proved successful in controlling the corn-ear worm. As the winter is passed in the soil, deep fall plowing and harrowing will crush some of the pupae and others will be exposed and killed during the winter.

#### ONION THRIP (*Thrips tabaci* Lind.)

This thrip has been reported from sections of Idaho where damage has been done the onion crops. This insect is very small and probably will not exceed one-twentieth of an inch in length. It sucks and bites the green foliage, leaving small yellowish dots on the leaves. The plants usually are stunted as the leaves become dry when severely attacked.

CONTROL: When the thrips appear, spray with kerosene emulsion or Black Leaf 40.

#### RASPBERRY CANE-MAGGOT (*Phorbia rubivora* Coq.)

The cane-maggot has been very destructive in this state during the past few years. The adult is a fly which resembles the house fly, but is smaller.

The female deposits her eggs on the young canes. Upon hatching, the young maggot enters the cane, usually girdling the shoot at the point of entrance. It tunnels its way down thru the pith to the base of the cane and transforms to a pupa. The adult does not emerge until the following spring. That part of the cane above the girdle soon wilts and droops.

CONTROL: Prune out the canes when they begin to droop, cutting several inches below the girdle. All cuttings should be burned. There is no spray that will control the maggot.

# Spray Materials

## LIME-SULFUR

Lump lime (pure) .....50 pounds  
 Sulfur .....100 pounds  
 Water .....50 gallons

Break the lime into small lumps and slake in the cooker with hot water. Make a smooth paste of the sulfur with water and add to slaking lime. Mix thoroly. Add water to make fifty gallons. Boil vigorously 45 minutes to one hour. Add water as needed to keep the volume up to 50 gallons. Stir continuously. When thru boiling let settle, then draw off the clear liquid. The material may be kept for two or three days in an open barrel if covered with a thin layer of paraffine or oil to exclude the air. Commercial lime-sulfur may be bought already made and if used at the right dilution is effective. A little milk of lime well strained will increase adhesiveness. Dilute home-made or commercial lime-sulfur as follows:

Reading of hydrometer		Amount of dilution No. of gals. of water to one gal. of lime-sulfur solution	
Degrees baume	Specific gravity	Winter spray 5 deg. baume	Summer spray 1 deg. baume
34	1.306	8 <sup>3</sup> / <sub>4</sub>	43 <sup>1</sup> / <sub>4</sub>
32	1.283	8	40
30	1.261	7 <sup>1</sup> / <sub>4</sub>	36 <sup>1</sup> / <sub>4</sub>
28	1.239	6 <sup>1</sup> / <sub>2</sub>	32 <sup>3</sup> / <sub>4</sub>
26	1.218	5 <sup>3</sup> / <sub>4</sub>	29 <sup>1</sup> / <sub>2</sub>
24	1.198	5	26
22	1.179	4 <sup>1</sup> / <sub>4</sub>	22 <sup>3</sup> / <sub>4</sub>
20	1.100	3 <sup>1</sup> / <sub>2</sub>	19 <sup>3</sup> / <sub>4</sub>
16	1.124	2 <sup>1</sup> / <sub>2</sub>	15

## SOLUBLE SULFUR OF SPRA SULFUR

For a dormant spray, use:

Sulfur Compound.....10 to 12 pounds  
 Water .....50 gallons

For summer spraying,

Soluble Sulfur....2 pounds		Spra Sulfur....11 <sup>1</sup> / <sub>2</sub> pounds
Water .....50 gallons		Water .....50 gallons

Wash the sulfur compound into tank thru sieve as tank is being filled.

## ATOMIC SULFUR

For Apple Scab,

Atomic Sulfur....12 pounds		Mildew on Apples,
Water .....100 gallons		Atomic Sulfur....6 pounds
		Water .....100 gallons

Atomic sulfur is not recommended for use during the winter or dormant season.

BORDEAUX MIXTURE

- Blue Stone.....5 pounds
- Lump Lime.....5 pounds
- Water .....50 gallons

Dissolve the blue stone (suspended in sack) in 25 gallons of water. Slake lime in another vessel and dilute with 25 gallons of water. Pour these solutions into a third vessel at the same time.

ARSENATE OF LEAD

Spray for codling moth:

- No. 1. Arsenate of lead (paste).....2 pounds
- Water .....50 gallons

- No. 2. Arsenate of lead (powder) .....1 pound
- Water .....50 gallons

For more resistant insects:

- No. 1. Arsenate of lead (paste).....3 pounds
- Water .....50 gallons

- No. 2. Arsenate of lead (powder) .....1½ pounds
- Water .....50 gallons

In mixing the amount of arsenate of lead for each spray tank, it should be worked into a thin paste in a small amount of water and should never be thrown as a mass into the spray tank. See that each package of arsenate of lead bought bears certificate of analysis as required by the insecticide law.

PARIS GREEN

- |                             |  |                             |
|-----------------------------|--|-----------------------------|
| Air-slaked lime ...2 pounds |  | Air-slaked lime ...2 ounces |
| Paris green.....¾ pound     |  | Paris green.....1 ounce     |
| Water .....50 gallons       |  | Water .....4 gallons        |

For cabbage worm, add three pounds of soap to 50 gallons of water instead of the air-slaked lime.

POISON MASH

- Bran .....16 pounds
- Paris green.....1 pound
- Salt .....½ pound
- Syrup .....1 gallon

POISON WASH FOR TREES

- Soap .....2 quarts
- Crude carbolic acid..½ pound
- Paris green.....2 ounces
- Lime .....2 pounds

HELLEBORE

- Hellebore .....1 to 2 pounds
- Water .....50 gallons

Hellebore may also be mixed with flour and dusted on plants.

DORMANT SOLUBLE OIL

- For heavy incrustation of scale, use:
- Dormant Soluble Oil.....12 gallons
- Water to make.....200 gallons

## MISCIBLE OIL NO. 1

For a dormant spray, use:

Miscible oil No. 1.....10 or 12 gallons  
Water to make.....200 gallons

For a summer application, use:

Miscible oil No. 1.....3 or 4 gallons  
Water to make.....200 gallons

Measure out the desired quantity of oil, add a small amount of water, stirring thoroly until the oil turns to a uniform, creamy color, then place in spray tank with full volume of water.

## SCALECIDE

For a dormant spray:

Scalecide .....6 or 7 gallons  
Water .....100 gallons

First shake barrel or can well. Fill tank nearly full of water, add six or seven gallons of scalecide to every 100 gallons of water. Always pour scalecide into water rather than water into scalecide.

## KEROSENE EMULSION

Or	}	Kerosene .....2 gallons
		Whale Oil Soap ..... $\frac{1}{2}$ pound
		Laundry Soap .....1 pound
		Water .....1 gallon

Dissolve soap in hot water. Add kerosene to hot suds. Agitate the mixture to emulsify. Dilute this stock solution at the rate of one gallon to ten gallons of water. The oil should not separate and come to the top of the diluted solution. If it does, it is unsafe to use.

## BLACK LEAF 40

Black Leaf 40.....1 quart	Black Leaf 40.....1 ounce
Soap .....7 pounds	Soap .....1-5 pound
Water .....200 gallons	Water ..... $6\frac{1}{4}$ gallons

## HOW TO SPRAY

No spray will give good results unless properly applied. Drench every part of the tree thoroly. The most difficult places to reach should receive the most careful attention. From two hundred to two hundred and twenty-five pounds pressure should be maintained to drive the spray into every crack, every calyx cup, behind the buds and into the bud scales. The spray must wet thru the wool of the woolly aphid to be effective. If lower pressures are used, greater time will have to be spent to cover the surface. *Spraying out of season is valueless.* All pests must be destroyed when they can be reached and before the damage is done. Learn the life history of the various pests. Use the right kind of material. Efficiency is measured by the percentage of clean fruit. For further information, write the Agricultural Experiment Station, Moscow, Idaho.

AVAILABLE PUBLICATIONS

The following Publications may be obtained, without cost, by addressing the Agricultural Experiment Station, Moscow, Idaho.

**Bulletins**

60. Conditions affecting the Production of Denatured Alcohol in the Northwest.
65. Alaska Wheat Investigations.
72. A Report on the Milling Properties of Idaho Wheat.
73. A Study of Idaho Butter with Suggestions for Improvement.
75. Composition of Irrigated and Non-Irrigated Fruits.
76. Tomato Culture in Idaho.
77. Lamb Feeding and Sheep Husbandry in Idaho.
78. Irrigation Practice.
79. Potato Culture.
81. Soils of the Cut and Burned-Over Areas of North Idaho.
82. Canning Fruits and Vegetables on the Farm.
84. The Annual Report of the Experiment Station for year Ending June 30, 1915.
85. The Use of Lime-Sulfur as a Summer Spray for Apple Scab.
86. Some Poisonous Plants of Idaho.
87. Insect Pests of the Orchards and Gardens of Idaho, and their Control.

**Circulars**

- No. 1, Spray Calendar.
- No. 2, Field Peas.

The list below may be obtained, also without cost, by addressing the Department of Agricultural Extension, Boise, Idaho.

**Bulletins**

3. Measurement of Irrigation Waters.
5. Hog Cholera in Idaho.
6. Rural School Lunches.
7. The Alfalfa Weevil.
8. Directory of Idaho Pure-Bred Breeders.
9. The County Agriculturist Movement.
10. Batters and Doughs.
11. Third Year Sewing-Girls' Club Work.
12. Instructions for Canning Fruits and Vegetables.
13. First Year Sewing-Girls' Club Work.
14. First Year Cooking—"Bread."
15. General Club Announcement.
16. Meat.

**Circulars**

1. Weeding Out Poor Orchard Varieties.
  9. Hints to Help Chicken Raisers.
  10. Home Economics Schools.
  11. Farmers' Schools.
  14. How to Keep Fowls Healthy.
  15. Fitting Fowls for Exhibition.
- Idaho Farm Hints**
20. Help Fight Hog Cholera.
  21. Warning. Look Out for Potato Diseases.