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University of Idaho

# Agricultural Experiment Station

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DEPARTMENT OF ENTOMOLOGY

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THE SAN JOSE SCALE IN IDAHO

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BY J. M. ALDRICH

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PRESS OF THE NORTH IDAHO STAR  
MOSCOW

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### BULLETINS.

The regular bulletins of the Station are sent free to all who request them.

Bulletins issued since the close of the fiscal year, June 30, 1897:

11. Smuts and Rusts of Grain in Idaho, and the Most Approved Methods of Dealing with Them.
12. Sugar Beets in Idaho.
13. Meteorology.
14. Twelve of Idaho's Worst weeds.
15. Annual Reports, 1897-1898, and Miscellaneous Information.
16. The San Jose Scale in Idaho.

## THE SAN JOSÉ SCALE IN IDAHO

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BY J. M. ALDRICH.

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The San Jose scale (*Aspidiotus perniciosus* Comstock) is at present one of the most widely spread and troublesome insects that affect the horticultural industry in the United States. It was introduced from some foreign country into California about 1870, and derives its common name from having first caused noticeable damage in the vicinity of San Jose. From that state it spread into Oregon and Washington and thus eventually into Idaho. At the same time it extended its range into New Mexico. In 1893 the startling discovery was made by the Department of Agriculture that this scale had established itself in a number of places in eastern and southern states. Since that time it has been found in nearly all the states east of the Rocky Mountains, and has received the attention of nearly all the Experiment Stations of the country in one way or another. As the situation in Idaho is peculiar, and the present seems a critical time in this regard, this bulletin is issued in order not only to discuss the subject of remedies, but the equally important subjects of present distribution, means of introduction, and prospect of ultimate spread in our state. While the published bulletins of other Stations have been drawn upon, and especially those of the Department of Agriculture, much of the bulletin has reference to local conditions, and is the fruit of investigations extending over several seasons.

I am indebted for many useful suggestions to the horticultural

inspectors in those sections of the state where the scale occurs, in particular to Mr. A. McPherson of Boise, whose spraying has shown what is possible and has given encouragement to all who have seen its effects; to Messrs. R. M. Gwinn of Caldwell, A. F. Hitt of Weiser, and L. A. Porter of Lewiston. I have also received assistance in my investigations from Messrs. N. A. Jacobsen and W. G. Whitney of Payette, A. E. Gipson of Caldwell, and Robt. Schleicher and M. J. Wessels of Lewiston.

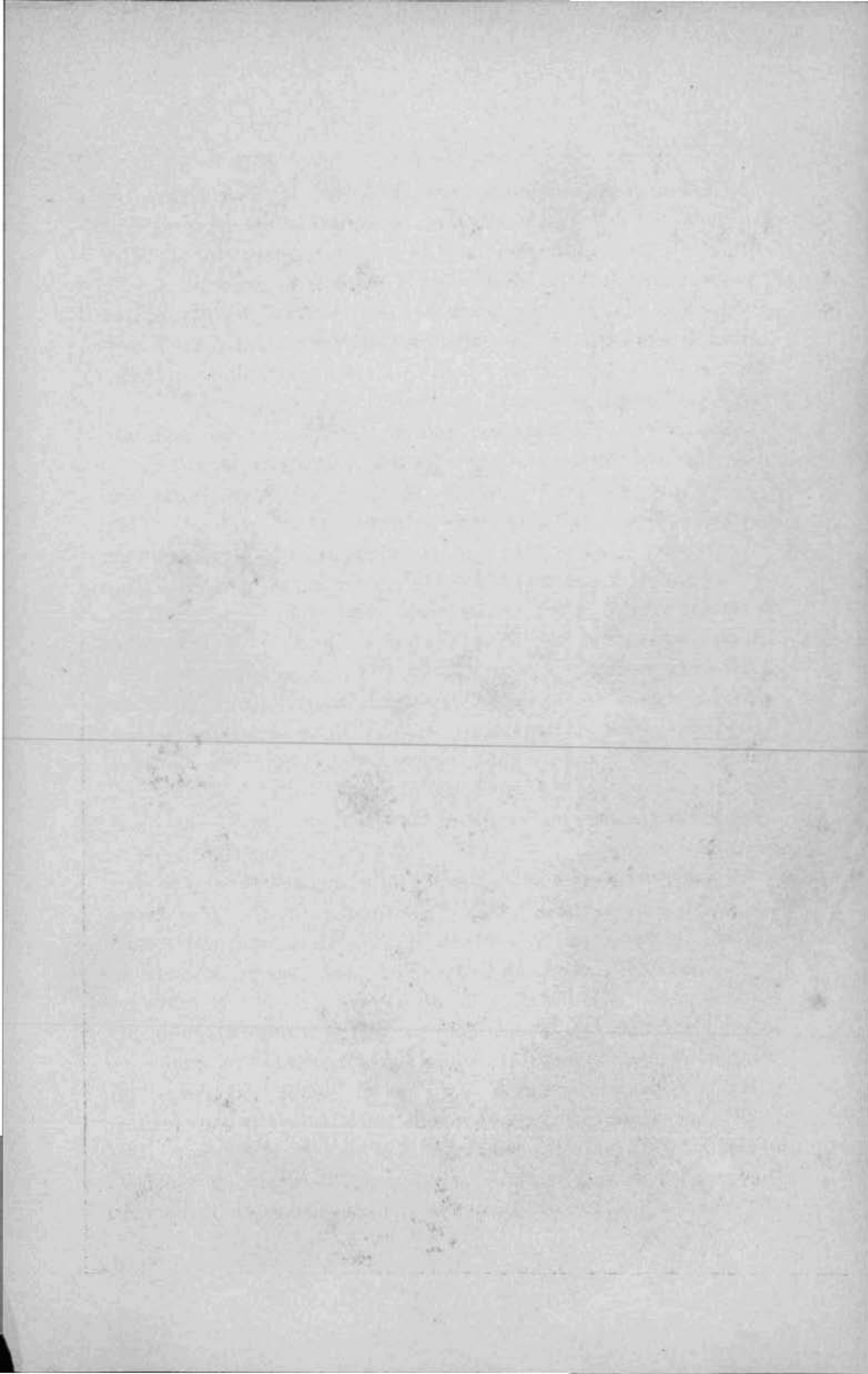
*Description.*—The San Jose scale may be recognized with almost absolute certainty by the following simple characteristics:

The ashy-gray scales, usually occurring in large numbers, are circular in shape with a slight protuberance in the middle. This protuberance is lemon yellow in some specimens (never orange yellow); in other specimens the yellow color is obscured by a thin dark film over the middle of the scale, which may be removed by gently pushing with the point of a pin. The entire scale may be lifted from the bark by putting a pin under the edge; this discloses a small, roundish, yellow animal underneath, looking, as Inspector Gwinn has remarked, "exactly like a particle of Jersey butter." The scales are almost always of varying sizes, but the largest are no larger than the head of a pin.

Fig. 1 shows the appearance of the scale on pear, and some specimens enlarged.

The only other scale at all similar in form that is known to occur in our state is the so called "Putnam's scale" (*Aspidiotus ancylus* Putnam), which has been found so far at and near Boise, and at Blackfoot and Malad City. This insect seems to thrive in colder climates than the San Jose scale, and is not injurious to any marked extent. It usually occurs in small numbers, and the protuberance of the middle is orange in color instead of lemon.

*Effects.*—Each scale insect has a long, slender proboscis, or "bill", which may be compared to that of a mosquito. By means of this organ it sucks out the juice of the plant. It appears also to inject some poisonous substance into the tissue on which it feeds, as the bark usually turns red and growth ceases in the im-



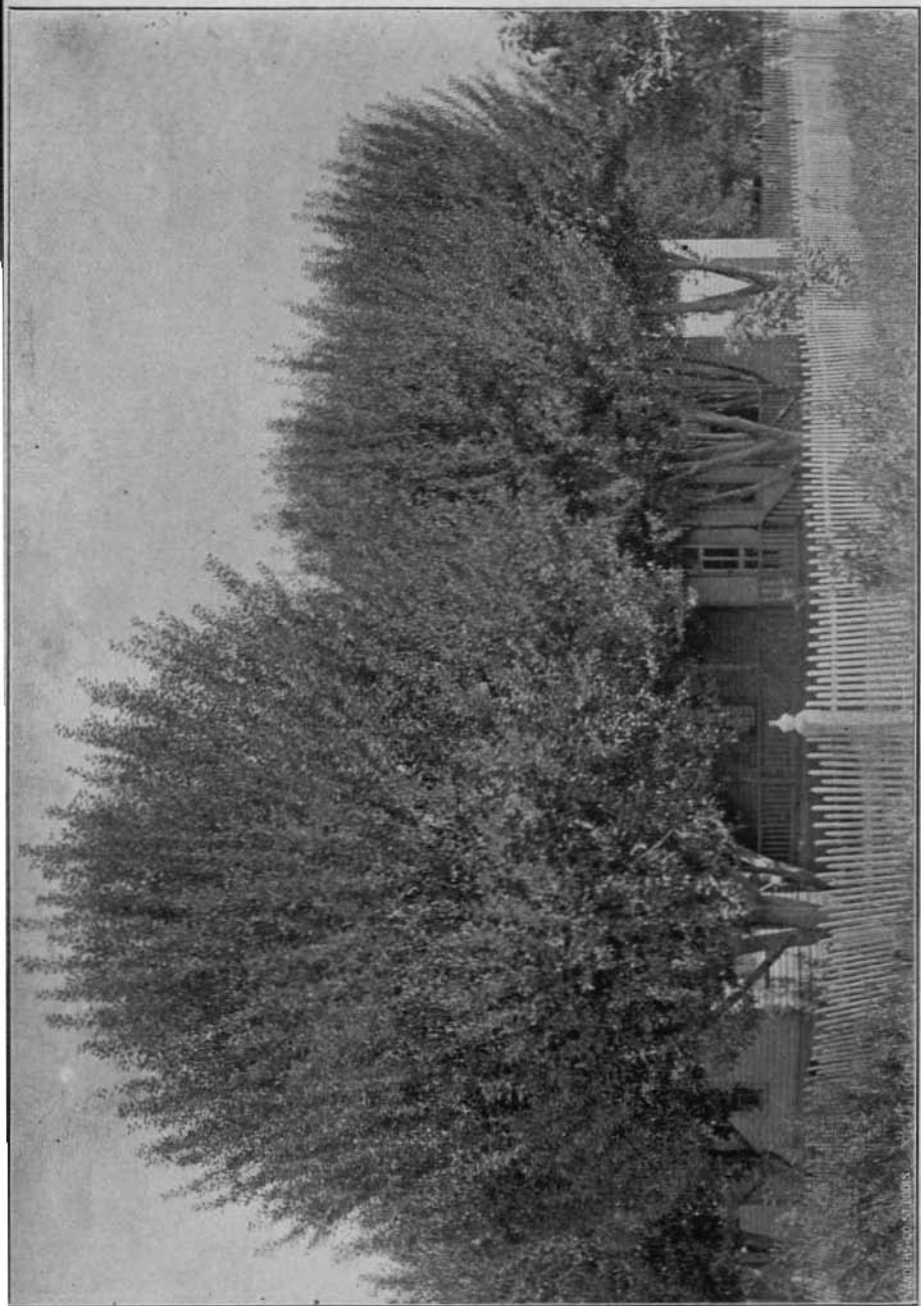


PLATE I. APPLE TREES IN BOISE THREE YEARS AFTER A SINGLE SUCCESSFUL SPRAYING FOR SAN JOSE SCALE.

mediate vicinity. There is no other scale insect that has such a marked effect on vegetation infested. In one to three years after the first attack the tree will generally die if not treated; sometimes, however, it will survive a year or two more. By the second year the scale generally becomes so abundant as to form a crust on many branches, and to cover the fruit and leaves also.

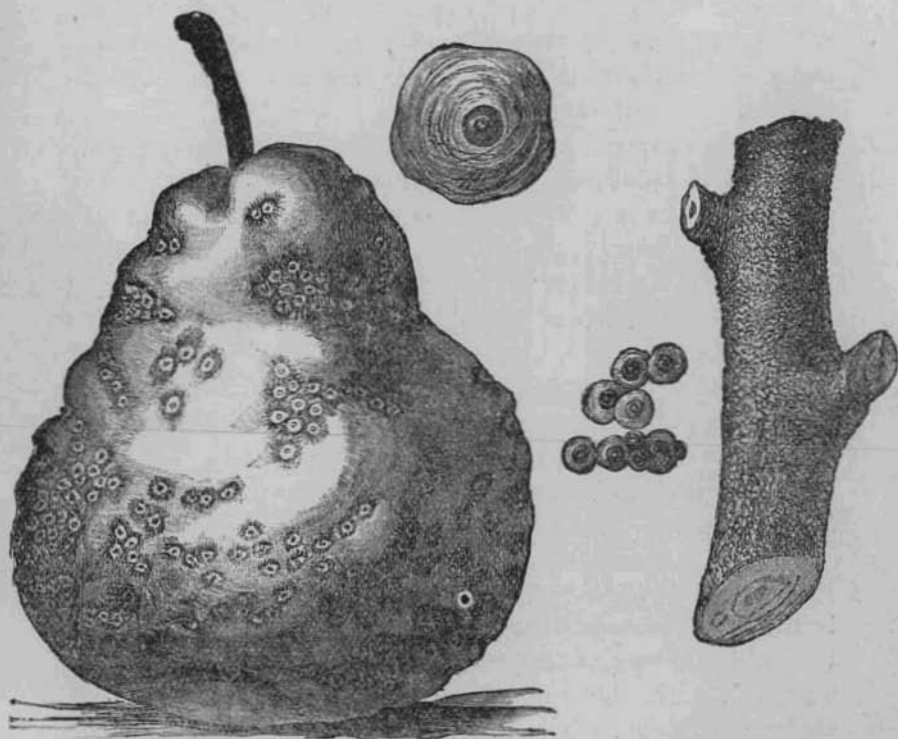


FIG. 1.—San Jose Scale on pear fruit and twig, natural size, with enlarged male and female scales and a single scale above still more enlarged. [Howard, Yearbook Dept. of Agriculture, 1894.]

*Plants infested.*—The Department of Agriculture has prepared a list of 55 plants upon which this insect has been observed. Notwithstanding this formidable showing, it is a fact that this scale is of rare occurrence except upon apple, peach, pear, plum, cherry, prune, raspberry, blackberry, currant, gooseberry and rose. In

many cases where an infested orchard stands close to poplars, willows, other shade trees and ornamental shrubs, the scale becomes introduced on these but it does not thrive as on the list first given, and in most cases I believe will die out unless renewed from other sources. Still this habit of partial adaptation to other foods gives rise to considerable trouble when the extermination of the pest is attempted; for instance in Lewiston the willows fringing the Clearwater River have become extensively infested, and must be cut out before any thorough work in adjacent orchards can be accomplished.

There is, however, one variety of tree fruit that seems entirely exempt from attack,—the Black Tartarian cherry. Mr. Porter called my attention to a striking illustration of this fact near Lewiston; an old apple orchard was dying of scale, while a young tree of this variety of cherry, standing between the apple trees, its foliage mingling with theirs, did not appear to have a single scale.

The apricot is another fruit but little affected: in fact, for a long time supposed to be entirely exempt. Enough cases have been observed to show that the scale can get along pretty well upon it.

The Leconte and Kieffer pears are found in the east to be less affected than other varieties.

*Symptoms of Attack.*— The discovery of the scales themselves is the only positive evidence. However there are several indications which to the practiced eye quickly show that something is wrong. An unthrifty appearance of the tree, the red marks on apples, pears, etc., often showing at a considerable distance; in bad cases the bare, dead shoots and the crusted appearance of the bark,— all these are indications which may be observed without that careful scrutiny which detects the individual scales. Recently in South Idaho my attention was called to a prune orchard in which spraying had destroyed the scale except on a few branches; on these branches the dead leaves were still hanging like signals of distress, the remainder of the trees being bare.



Thus the infested parts were made very conspicuous and could quickly be cut off and destroyed.

*Growth and Development.*— We are indebted to the Department of Agriculture for the most complete study of the life history of this scale that has yet been made.

The winter is survived only by scales that are about two-thirds grown, the younger and older ones being killed by it, consequently, there is a time in the spring after the trees are in leaf when the scales appear to be dormant, as they are simply growing to maturity without any visible movement. At this time and later on in the summer, a part of the scales are passing through a most remarkable change, from which they emerge as the adult

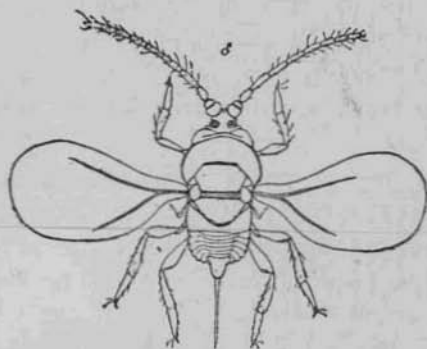


FIG. 3.—Adult male, greatly enlarged. [Howard, Yearbook Dept. Agriculture, 1884.]

males of the species; the tiniest, frailest, gauziest little creatures that could well be imagined, having wings but no mouths, so that henceforth they cannot damage the trees, except by playing their part in the reproduction of their kind. Figure 3 shows one of these males greatly magnified.

From what has been said it will be seen that the full grown scales remaining attached to the bark are all females (Fig. 2). As soon as they reach a sufficient maturity they begin to bring forth young scales, for there are no eggs deposited by this species. The date of appearance of the first young in our state has not been observed with sufficient accuracy. In 1898 none had ap-

peared up to May 26 at Lewiston, where the season is a little earlier than in other parts of the state. It is pretty safe to say that the appearance is not earlier than June 1 to 10 in the various altitudes where it occurs. This is later than in a corresponding climate in eastern states by about three weeks. The newly-born scale insect has no shield on its back. It is pure yellow in color, with well developed legs and antennæ and for a time is quite active, walking about in search of a favorable place to insert its proboscis in the bark. It is just large enough to be seen with the naked

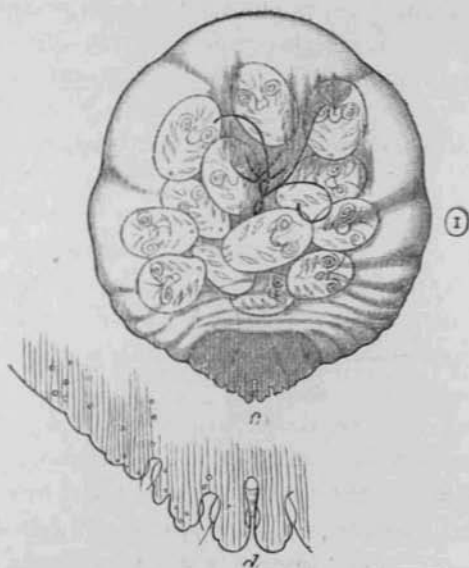


FIG. 2.—Adult female removed from Scale, showing developing young inside, greatly enlarged: *a*, anal plate still more enlarged. The small mark in the oval at right is actual size of *c*. [Howard, Yearbook Dept. of Agriculture, 1894.]

eye, especially if moving. As soon as it has found a place to its liking, it anchors itself by thrusting in its proboscis, and *never leaves that place*, unless it develops into a male and flies away. In other words, the scale loses all power of locomotion within a few hours and according to Howard and Marlatt "does not normally travel far from the parent insect, and usually rests within a few inches of the old scale, or at the first available point." The

bearing of this important fact upon the spread of the insect will be readily seen. The over-wintered females continue to produce young at the rate of 8 or 10 a day for six weeks, which completes the life cycle for them. The first young are mature and also producing offspring in a little less than six weeks, so there is an uninterrupted succession of new-born insects for the remainder of the summer and until pretty heavy frosts in autumn. The possible increase in a season from a single female is something awful to contemplate, having been figured by the Department of Agriculture as 3,216,080,400 individuals. Of course this is presented only as a theoretical possibility; if we divide it by 1000, we shall still have an inconceivable number. "Neither the rapidity with which trees become infested nor the fatal effect which so early follows the appearance of this scale insect is therefore to be wondered at."

*Methods of Distribution.*—Where the scale does not occur within a mile or two, the almost universal method of distribution is by nursery stock; that is, young trees already infested are received from a dealer in some other section and placed in the orchard. *This is the most important point to guard in all places where the scale does not already occur.*

In adjoining orchards the scale is carried chiefly by other insects; the young being so small and active, it can climb upon almost any other kind of insect that may alight by it and thus secure "free transportation"—that delight of the soul—to the next stopping place. Many instances of insects of other kinds carrying the young scale have been observed, some in our own state. Birds also probably carry the scale, but no actual observations have come to my knowledge. The distance that is covered by the young scale in these free rides is usually small; one instance of a mile is reported in the east—almost always it is only a few rods, which indicates that insects rather than birds do most of the carrying. It is important to remember that *the female scale never has wings, and cannot crawl except for a short time when first born.* Some of the best horticulturists of the state have thought

that these statements could not be true, in view of the actual spread generally observed; but they are as certain as the law of gravitation. Only by means of outside help does the scale ever pass from one orchard tree to another unless the branches touch or there is undergrowth of a kind it can live on.

The introduction of the scale on ripe fruit is a possibility. Apples, pears, etc., often have plenty of full-grown scales on their surface, and these continue to produce young doubtless for a time after the paring is removed and thrown away. These parings naturally attract flies and if a fruit tree is near by the rest is easy.

As a matter of fact, it is doubtful if one case in fifty comes from this cause; yet even this is exceedingly important. The solitary case of scale which we now have in Owyhee county probably came about in this way. The owner of the place formerly bought much fruit from infested sections, and two fruit trees close behind his house were first attacked, as I am informed by Inspector Gwinn.

*Present Distribution in Idaho.*—The accompanying map of the state shows all localities where the scale occurs at present, so far as known. The crosses indicate the areas only in a general way, and each cover a number of cases, except in Owyhee county, where only one orchard is affected.

It will be seen at a glance that there are two independent sections affected, one in North Idaho, with Lewiston as its center, the other in South Idaho, extending from Boise down to Weiser. In other words, the two finest horticultural sections of the state are infested.

*How Far Will It Spread?*—This question is one of the most interesting and important that can be asked about the scale in Idaho. After several years of study it is still impossible to make any positive statements in regard to some of the most extensive sections of fertile land in the State.

If we may judge by the experience of the East, there is no section of Idaho where apples will grow well that may not, so far as climate goes, ultimately furnish a breeding place for the San Jose

## MAP OF IDAHO

## Explanation:

Crosses indicate localities infested by San Jose scale.  
 Circles indicate Putnam's Scale.  
 Dotted line marks boundaries of Snake River Plain.



Scale, since New York, Michigan and even Southern Minnesota are affected by the insect. It is practically certain, however, that climatic conditions west of the Rocky Mountains serve to restrict its spread to a much greater degree. For instance, while the

scale has been known for some ten years in the vicinity of Lewiston, it has so far confined itself exclusively to the narrow, deep valleys or canyons of the Clearwater, Snake and Potlatch rivers, so that orchards on the adjoining table lands are as yet entirely free from it, the difference in altitude being from 1400 to 2000 feet, the distance in a direct line being in some cases only a mile or less but usually two to four.

Considering the age of the upland orchards and the numerous opportunities that have probably occurred for introduction on valley grown fruit and in other ways, there is certainly great reason to hope that in North Idaho the scale will not extend beyond the narrow valleys mentioned.

In South Idaho the question is much more difficult. Here we have, as indicated by the dotted lines on our map, an extensive plain following the course of the Snake River for almost the entire width of the state. In this plain there is a gradual decrease of altitude and a correspondingly warmer climate from the east toward the west. The scale is already well established in the western end of this plain, where fruit raising is now a well settled industry. The eastward spread of the scale appears to have been stopped rather by absence of orchards than by climate. The researches of the Department of Agriculture show that the life of this great plain, both vegetable and animal, is substantially the same in its entire extent, which would indicate that an insect capable of existing in one part of it could exist in any other. This method of argument, however, must be used with caution, for it is a well known fact that peaches and grapes do not thrive equally well at Blackfoot and Weiser.

All my observations tend to this conclusion: The scale is capable of existing in any part of the arid section of Idaho where peaches do well; how much further, it is at present impossible to say. Certainly it has as yet occupied only a small fraction of the territory in our own state that is well suited to it. If not restricted by some effectual means, I look to see it extend over at

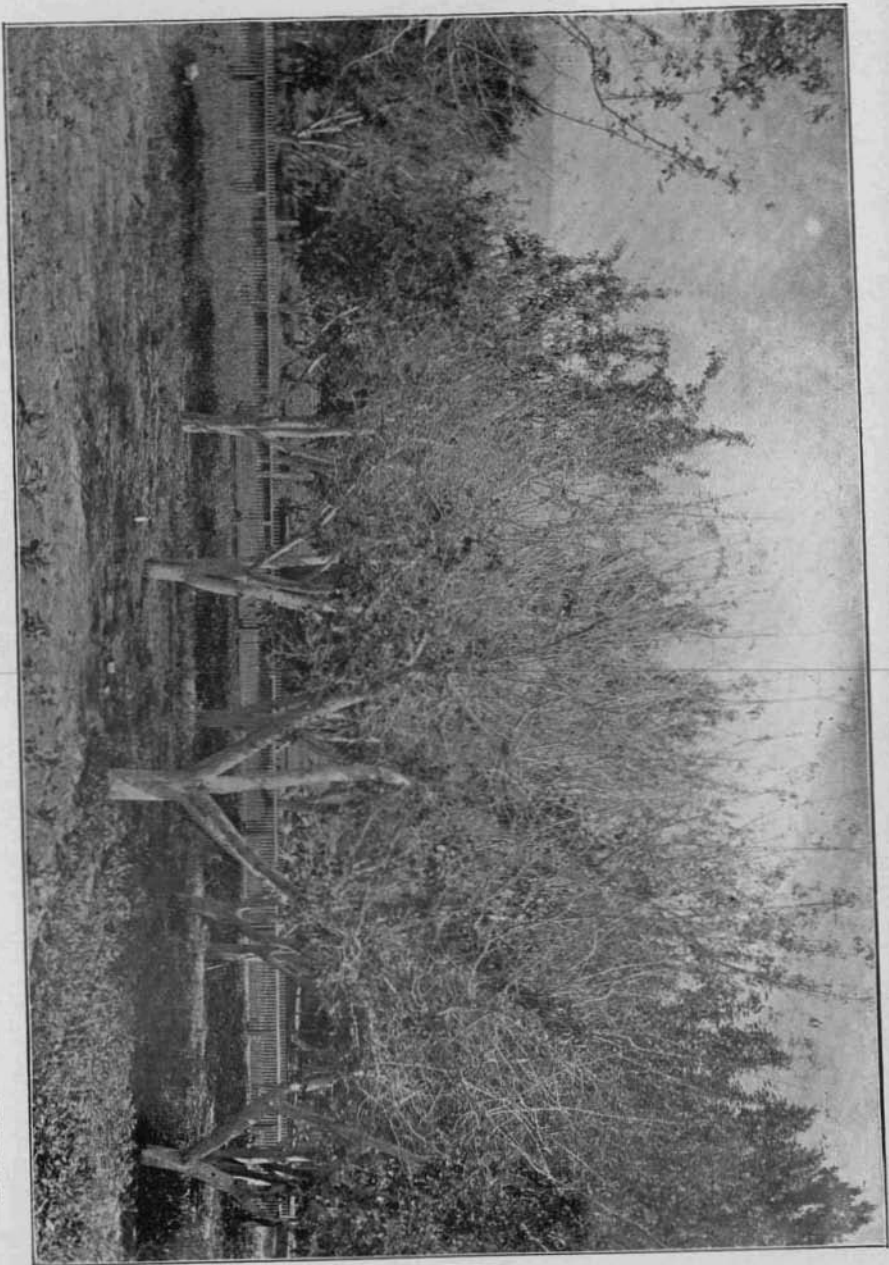
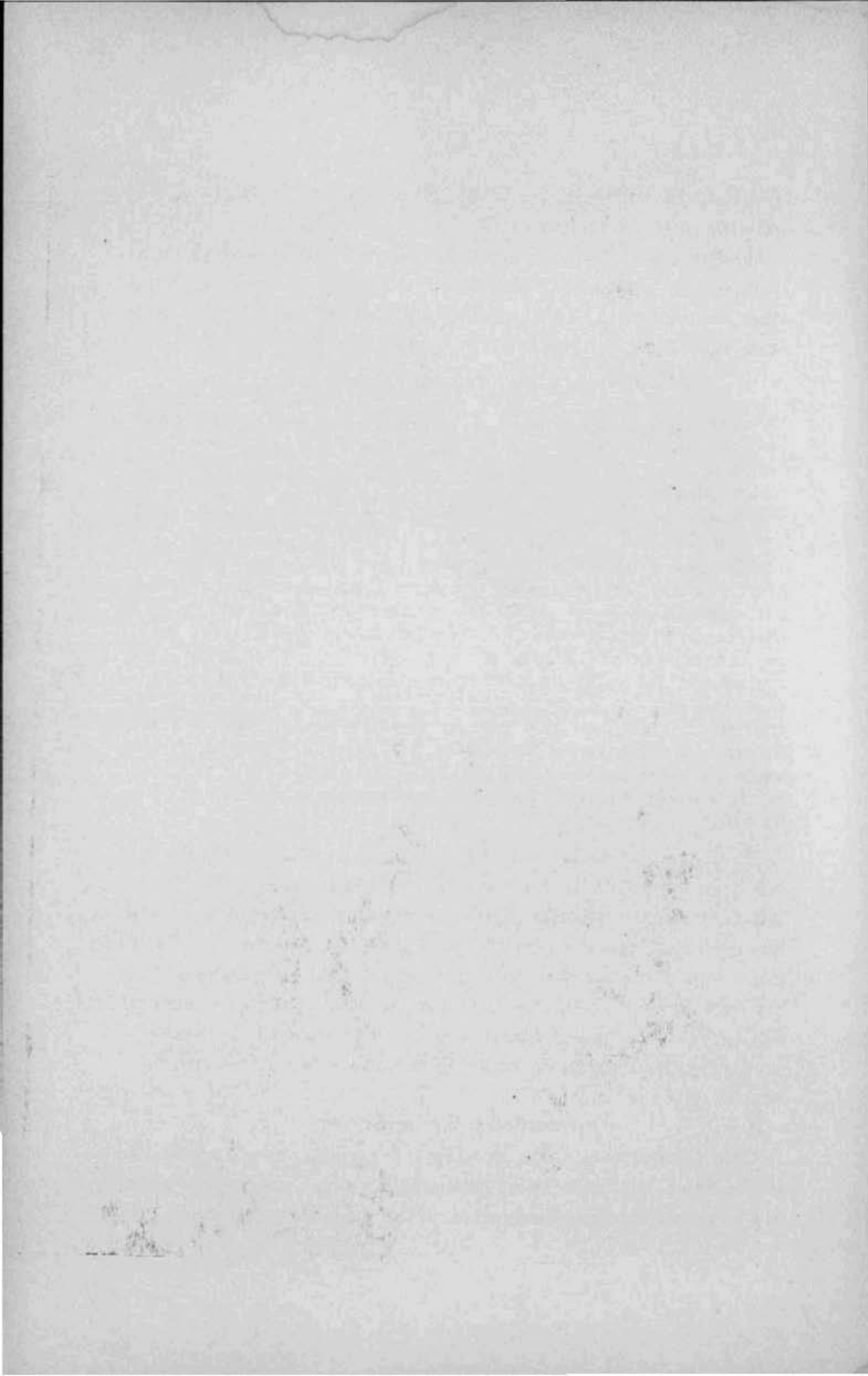


PLATE II. APPLE TREES IMPROPERLY SPRAYED FOR SCALE LAST WINTER,—STILL INFESTED.





least half the entire Snake River plain, as the development of orchards offers opportunity.

*Remedy.*—As there is one preeminent and complete remedy, no space will be occupied in this bulletin with the discussion of any other. I quote Mr. McPherson's formula from the bulletin of the State Board of Horticultural Inspection:

#### Sulphur, Lime, Salt and Lye Solution.

"Unslaked lime.....	40 pounds
Sulphur.....	20 "
Salt .....	15 "
American concentrated lye.....	2 "
Water.....	60 gallons

**"DIRECTIONS FOR PREPARATION.**—Place 20 gallons of water in a boiler and heat to the boiling point; then put in 10 pounds of lime, 2 pounds of lye and 20 pounds of sulphur. Boil for one and one-half hours, or until the sulphur is dissolved. It will then be of an amber color. While the above operation is being performed, slake in another suitable vessel 30 pounds of lime, and while it is hot (caused by the slaking of the lime) add the salt and stir until it is dissolved. Then add the whole to the contents in the boiler and cook for one-half hour longer. Strain this mixture into the receptacle used in spraying, diluting it with as much water as is necessary to make 60 gallons.

"In extreme cases of scale, one or two more pounds of lye can be added to the formula."

This is the old standard "sulphur, lime and salt solution" that has been in use on the Pacific coast for some years, but it contains one additional ingredient—lye—which, though not new, has been but little used heretofore. This is an important addition, and I am satisfied from Mr. McPherson's experiments and my own observation that it increases the killing power to a marked degree. At the same time it does not increase the difficulty of preparing the compound, and is very inexpensive. Therefore it should never be omitted.

#### Directions for Spraying.

Unless the directions for making and applying are carried out to the letter, the application generally does but very little good. My observation has been that fully half the spraying with

sulphur, lime and salt in our state has been almost entirely useless, mere time and money thrown away. Of what avail is it to kill only nine-tenths of the insects on the tree? It only makes room for the next generation and gives the tree a lease of its sickly life for another year, to spread contagion in adjoining orchards. The aim should be *absolute eradication*, and anything less is a failure. The work of Mr. McPherson in Boise, referred to farther on, shows whether this is visionary.

The following points are essential, and should be carefully attended to:

1. Unless the trees are quite small they should be cut back. Old trees with bushy tops cannot be successfully sprayed without first thinning and shortening the top, and the more radical the treatment in this regard the more certainty of exterminating the scale. All prunings should be burned.

2. Use the spray *hot*. If it gets cooled to a luke warm temperature, stop immediately and heat it over again.

3. Be careful to cover every particle of surface on the tree. It is absolutely certain that no scale will be killed unless it is hit.

4. Within a day or two carefully examine every tree and cut off and burn every tip of a branch that is not thoroughly white-washed with the spray.

5. Be vigilant through the ensuing season in watching for any spots that may have been missed. If living scale appears on an isolated branch here and there, cut off the branch and burn it, as early in the season as it can be found.

6. The time to spray is February. Choose a mild period if possible, as it is hard to keep a spray hot in cold weather. Some have thought that the best results come from spraying in the few days just prior to the bursting of the buds in spring. It is dangerous to wait so late, as the spray cannot be applied after the leaves are out, and something may prevent the application at the critical time.

On the other hand, spraying in the early part of winter is undesirable. Mr. N. A. Jacobsen of Payette, showed me a most striking illustration of this, where nearly a thousand bearing prune trees had been greatly damaged by spraying in December. A year afterward, it was easy to pick out the sprayed and unsprayed trees in that orchard, as the fruit spurs were nearly all killed on the former.

7. As an additional precaution, it should be carefully ascertained that no infested rose, currant, grape, etc., be left in the vicinity of the orchard to reintroduce the scale. There is no danger from sage brush, rabbit brush, and the other characteristic plants of arid sections; willows, poplars and other shade trees should be examined.

*Incidental Benefits of the Spray.*—There is no other kind of spray adapted to so many purposes as this one. It destroys the Pear Leaf Blister Mite in its winter quarters, the Woolly Aphis and Red Spider. In South Idaho it is believed to destroy at least in large part the apple scab, peach mildew, and other fungi. It retards the opening of the buds a few days, thus in some cases saving the crop from destruction by frost. I believe it kills the eggs of the aphis on apple and prune. Still further, it remains on the tree nearly all summer, keeping off borers; and when it ultimately finds its way to the ground it is a useful fertilizer. Could anything more be asked? More than one man who has used this spray considers that the application should be made annually, regardless of the scale, for the sake of the other benefits.

*What Has Been Done.*—As already stated, a great deal of ineffective work has been done against the scale in this state. This ought not to be a source of discouragement, provided it can be shown that properly directed work has been completely successful, and this is certainly the case. In Boise and vicinity, to take the most striking illustration, Mr A. McPherson has eradicated the scale from a considerable number of orchards with only one application.\* The directions for preparation and application of spray in this bulletin are based on his methods, and have

therefore stood the test of use with absolute success. Plate I shows a group of apple trees sprayed under his direction in the spring of 1896. The trees were cut back very close at the time, and were considerably infested with scale. The photograph was taken in July, 1898, after about three season's growth. No healthier or more vigorous trees could be found in the state.

On the other hand, Plate II shows an orchard in North Idaho dying with scale, although sprayed the previous winter with sulphur, lime and salt at an expense of nearly a dollar a tree. It is very evident that the work was badly done, besides being much more expensive than necessary. The trees were not cut back at all, which in itself would make success impossible. The plate is shown only to emphasize the absolute necessity of following proper methods in this kind of work.

*Can the Scale be Eradicated from the State?*—It has already been shown that it can be eradicated from individual orchards; the larger question, however, opens the way for many difficulties. Much can be done in some communities; in others less. For instance in Weiser only a dozen orchards are infested, and there is every reason to anticipate a campaign there this winter that will nearly if not quite free the town, and Washington county, of the pest.\* In some localities however the scale is so scattered that several years, at the best, must be devoted to the work before we can predict anything. The first essential is to stop the spread; the next to narrow down the territory already occupied. The horticultural inspectors, notwithstanding the weakness of the old law, have done a very useful work up to the present time. It may confidently be expected that they will have full authority to compel spraying hereafter. Without this it is vain to hope that the scale can be kept from spreading, still less that it can be exterminated.

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\*The single infested orchard in Owyhee county will probably be cleared of scale this winter also.