

---

---

UNIVERSITY OF THE STATE OF MISSOURI.

---

COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

Agricultural Experiment Station

---

BULLETIN NO. 41.

---

**The San Jose Scale in Missouri.**

---

COLUMBIA, MISSOURI.

---

January, 1898.

---

---

E. W. STEPHENS, Printer, Columbia, Missouri.

UNIVERSITY OF THE STATE OF MISSOURI.

---

COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

Agricultural Experiment Station.

---

BOARD OF CONTROL.

THE CURATORS OF THE UNIVERSITY OF THE STATE OF MISSOURI.

---

THE EXECUTIVE COMMITTEE OF THE BOARD OF CURATORS.

JUDGE NOAH M. GIVAN, Pres't, HON. CAMPBELL WELLS, HON. G. B. ROLLINS,  
Harrisonville. Platte City. Columbia

---

ADVISORY COUNCIL.

THE MISSOURI STATE BOARD OF AGRICULTURE.

---

OFFICERS OF THE STATION.

THE PRESIDENT OF THE UNIVERSITY.

H. J. WATERS, B. S. A.	DIRECTOR
PAUL SCHWEITZER, PH. D.	CHEMIST
J. C. WHITTEN, B. S.	HORTICULTURIST
J. M. STEDMAN, B. S.	ENTOMOLOGIST
J. W. CONNAWAY, M. D. C.	VETERINARIAN
T. I. MAIRS, B. Agr.	ASSISTANT IN AGRICULTURE
N. O. BOOTH, B. Agr.	ASSISTANT IN HORTICULTURE
C. THOM, B. S.	ASSISTANT IN BOTANY
W. B. CADY, B. S.	ASSISTANT IN CHEMISTRY
IRVIN SWITZLER	SECRETARY
R. B. PRICE	TREASURER
C. L. WILLOUGHBY	CLERK AND STENOGRAPHER

---

The Bulletins and Reports of the Station will be mailed free to any citizen of Missouri upon request. A cordial invitation is extended to all persons to visit the Station grounds at any time. Address, Director Agricultural Experiment Station, Columbia, Boone County, Missouri.

# The San Jose Scale in Missouri.

*Aspidiotus perniciosus*, COMST.

---

BY J. M. STEDMAN, Entomologist.

---

## SUMMARY OF RESULTS.

The investigations and experiments conducted by this station during the past two years on the San Jose scale have given results which are briefly summarized as follows:

I. The San Jose scale has been found infesting twenty private orchards in Missouri, some of which are already completely ruined, while others have only part of the trees beyond recovery, provided they be attended to at once.

II. Thirty suspected private orchards have not yet been inspected, and it is probable that some of these will be found to be infested, thus swelling the number of infested orchards beyond the twenty now known.

III. The scale has not been found infesting any nurseries within this state, although two nurseries have infested orchards within one half mile.

IV. In every known case the infection was introduced, unconsciously, on nursery stock from one or the other of two New Jersey nurseries with one exception, and that came from Pennsylvania.

V. While in most cases the scale was introduced from four to seven years ago, one infection was introduced but two years ago.

VI. The San Jose scale is distributed easily on nursery stock, cuttings, cions, buds, etc.; and naturally spreads from tree to tree and from orchard to orchard by birds and insects.

VII. In some localities in Missouri not only orchard fruit trees, but shade and ornamental trees, osage orange hedges, and some forest trees are now infested as a result of the natural distribution of the insect from the infested orchards.

VIII. The San Jose scale can best be killed in orchards by the use of *whale-oil soap*. The tree should first be severely pruned, and then thoroughly washed or sprayed on all sides with two pounds of whale-oil soap dissolved in one gallon of hot water. At least two applications are necessary and three are preferable. The first application should be made shortly after the leaves have fallen, the second some time during the winter, and the third in the spring before the buds swell. If only two applications can be made, the first and third are to be used, namely, the fall and spring applications. Hydrocyanic acid gas is practically the only other safe remedy, but this is more troublesome and expensive than the whale-oil soap method except for nursery stock.

IX. Spray pumps to be used for the application of hot whale-oil soap should have metal valves, since the soap destroys leather and rubber rapidly.

X. Do not be deceived and try to kill the San Jose scale during the summer by the use of ordinary insecticides, such as kerosene emulsion, etc. Use whale-oil soap, and use it only during the dormant state of the tree.

#### GENERAL DISCUSSION.

Two years ago the Department of Entomology of the Missouri Agricultural Experiment Station was established, and one of the first investigations undertaken was in reference to the San Jose scale, which up to that time had not been observed within the state limits, but which from its importance justified immediate attention, especially since it was being found in states east of us.

Since nurseries are the source from which the greatest danger could come, the principal nurseries were visited and inspected, together with some of the larger commercial orchards. The results showed that at least the nurseries of Missouri were



insect, and by describing and illustrating it, people owning infested trees would recognize it and take means to exterminate the same, and inform the station of the infection. Strange as it may seem, not a single infection was reported as a direct result of the circular; but incidentally through correspondence this station located three private orchards that were badly infested.

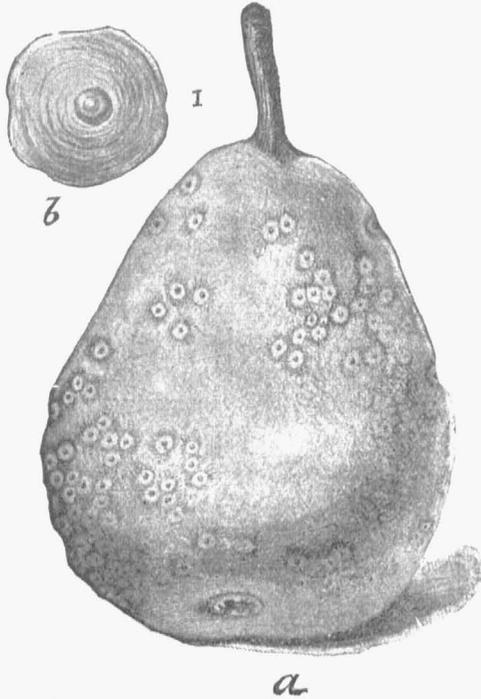
Having thus proven the presence of the San Jose scale within Missouri, and having traced the source of the infection to two New Jersey nurseries, these two nurseries were asked to furnish a list of Missouri customers to whom nursery stock had been shipped during the time their nurseries were, unknown to them at the time, infested. They kindly complied with the request, which resulted in three hundred and ten names. Circular letters were then mailed to each person, and the reports received were culled in order to separate the more probable infested localities; and lessen the time and expense of a personal inspection. The legislature having failed to appropriate funds (one thousand dollars was asked for) for the San Jose scale investigation and extermination, the State Horticultural Society gave two hundred dollars toward the work. The suspected orchards were therefore inspected as far as the funds at our command would permit, and as a result of the inspection twenty private orchards were found to be infested, while thirty suspected orchards remain uninspected, which, if they could be visited, would, no doubt, add to the list of those already known.

Some of the infested orchards are now completely ruined, while others may be saved in part provided immediate and strenuous efforts be made to exterminate the scale. In the majority of infested localities the scale can now be exterminated for a comparatively small sum of money; but in other places the insect has spread over such a wide area, and infests so many ornamental, shade, and forest trees, as well as fruit trees and bushes, that unless the legislature at once appropriate several thousand dollars for the work of extermination, the San Jose scale will always be with us, for in many places it is now beyond private control.

An idea of the known areas of infection can be obtained by observing the map—Figure 1—in which the infested regions, as far as we now know them, are indicated by stars, some of which cover several infested orchards for a radius of one half mile.

Missouri horticulture will suffer many million dollars loss in the near future unless every effort, both private and legislative, be at once made to exterminate this scale in the areas now infested, and to prevent its introduction into new localities. Each year that this matter is neglected greatly increases the difficulty and expense necessary to eradicate it, enlarges the infested area, and renders some new locality beyond control. No one can form an idea of the importance of this pest until they have seen an infested orchard—the damage done, the trouble and difficulty to kill the insect, and the impossibility experienced by the ordinary observer to detect its presence unless it occur in vast numbers, which indicates that it has probably already spread over a considerable area.

Missouri ranks third among the states in its horticultural interests. Many states whose fruit is a small item compared with Missouri's have already made appropriations for the investigation and extermination of the San Jose scale, and have enacted laws to prevent the introduction and spread of the pest. Missouri should have been one of the first to provide for its fruit interest in this respect, and it is to be hoped that every fruit grower, and every intelligent person in the state, will demand that our next legislature provide for this important work. Ample funds should be provided with which to carry on the investigation and work of extermination; and laws should be enacted to compel owners of infested plants to make immediate efforts to eradicate the pest, or submit to having it done; and also laws enacted to regulate the sale and distribution of infested nursery stock within the state. As it now stands, any infested nursery can ship its stock into Missouri.



*Fig. 2.—San Jose scale:—a, pear moderately infested—natural size; b, female scale—enlarged. (From Howard, Circular No. 3, second series, Division of Entomology, United States Department of Agriculture.)*



*Fig. 3.—San Jose scale:—Apple branch with scales in situ—natural size; enlarged scales above, at left. (From Howard, Circular No. 3, second series, Division of Entomology, United States Department of Agriculture.)*

## IMPORTANCE OF THE INSECT.

In 1873 the San Jose scale (*Aspidiotus perniciosus*, Comst.) was discovered on fruit trees in San Jose, California. From this locality it spread rapidly, until in twelve years it had infested every fruit growing region in that state, and had reached Oregon and Washington orchards.

It at once became known as the worst insect pest of the orchard, and is to-day capable of causing more damage to the fruit interests of the United States, or perhaps of the world, than any other known insect. The infested trees are either killed in two or three years or rendered worthless. Several million dollars damage has already been accomplished by this pest in California, and it now threatens to be even more destructive in the east. The scale is not readily detected by the casual observer, and consequently often remains unnoticed until the death of the tree calls attention to it. Unfortunately it multiplies rapidly. Each adult female continues to give birth to living young for a long period (six weeks), and there are several (probably four) generations each year. It infests the stems, twigs, leaves and fruit of nearly all deciduous fruit trees and bushes, and is extremely difficult to kill.

These statements are not made to cause unnecessary alarm, but merely to call attention to the facts in the case, in order that the proper precaution may be taken to prevent the introduction of this pest into new localities, and that every effort may be made to detect and exterminate it in the regions now infested.

Several articles that have lately appeared in newspapers and in circulars from nurseries comparing the San Jose scale with the Codling moth and other injurious insects and asserting that it is no more to be feared than such pests, are based on a misunderstanding and want of proper knowledge and practical experience. While the Codling moth and other injurious insects do cause a financial loss in that they injure the fruit, they do not destroy it and much less kill the trees. They are *injurious* insects, while the San Jose scale is a *dangerous*

insect and kills the trees rapidly, and is, moreover, hard to kill and to detect until too late to prevent its work.

OCCURRENCE EAST OF THE ROCKY MOUNTAINS.

The San Jose scale was found in New Mexico in 1892, and in August, 1893, in some of the eastern states, where it had evidently been unnoticed for four or five years. It had gained a good foothold in several localities, especially in two New Jersey nurseries, before its identity was discovered. The proprietors of the infested nurseries suppose the scale was introduced about 1887 on plum stock received from California

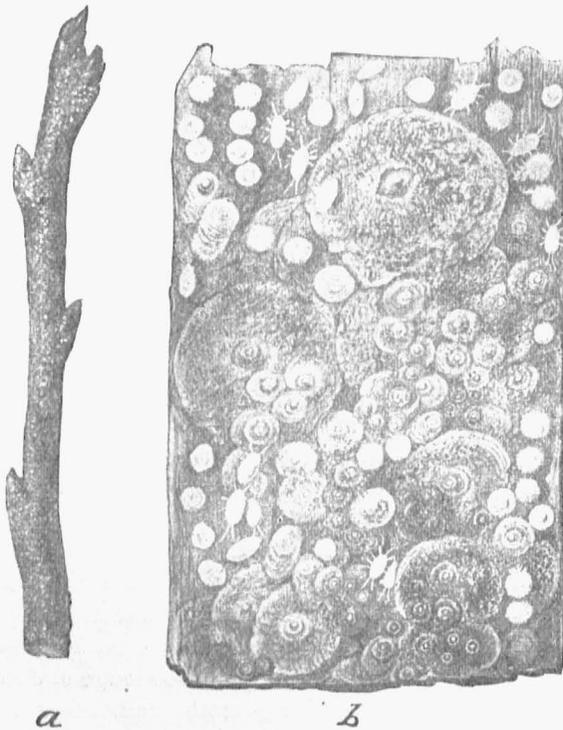


Fig. 4.—Appearance of San Jose scale on bark; a, infested twig—natural size; b, bark as it appears under hand lens, showing scales in various stages of development and young larvae. (From Howard and Marlatt, *Bulletin No. 3, N. S. Division of Entomology, United States Department of Agriculture.*)

through the agency of a Missouri nursery. As a result, Missouri has been publicly charged in several eastern Experiment Station bulletins and by the United States Department of Agriculture, as having introduced the San Jose scale in New Jersey, from which locality it has spread to Virginia, West Virginia, Maryland, Delaware, New York, Pennsylvania, Massachusetts, Ohio, Indiana, Illinois, Kentucky, North Carolina, South Carolina, Mississippi, Texas, Michigan, Missouri, Georgia, Florida, Alabama, Louisiana, and is found in New Mexico, Washington, Oregon, Idaho, British Columbia, Ontario in Canada, and of course in California.

From investigations conducted by this station it is evident that Missouri is not responsible for this introduction, since none of the stock from California on which the scale was supposed to have been, was planted in Missouri; it simply passed through one of our nurseries, acting as agent, and by order of a California firm. The responsibility, therefore, rests with California and not with Missouri.

#### OCURRENCE OF THE SAN JOSE SCALE IN MISSOURI, AND SOURCE OF INFECTION.

This station has just made an investigation of the whole subject of the San Jose scale in Missouri. Nearly all the nurseries and large orchards of the state have been visited and inspected, and all, except thirty, suspected orchards were visited and carefully examined. The results are briefly as follows:

The nurseries of Missouri are, as far as we can determine, free from the San Jose scale, and none that were examined showed any trace of ever having been infested. Two nurseries (St. Louis county and Randolph county) are, however, within one half mile of infested orchards.

Twenty private orchards in the state are known to be infested with the San Jose scale; while in some localities, ornamental, shade and forest trees have also become attacked.

All the original infested trees and bushes were purchased from New Jersey with one exception, that having come from Pennsylvania.

## WHERE TO OBTAIN UNINFESTED STOCK.

From the above facts it is evident that one can not be too cautious in purchasing fruit trees. Since many eastern and some southern nurseries are, or have been, infested with the San Jose scale, and since all Missouri nurseries appear to be free from this infection, it follows that Missouri horticulturists, and other fruit growers, would do well to either purchase their stock from home nurseries, or be very cautious in regard to the nursery selected. Subject all stock to careful inspection. And since every person has a right to demand on ordering nursery stock that such stock be inspected by an entomologist or state inspector and bear his certificate, it is advisable that this precaution be taken, although from the nature of the insect it does not absolutely prove that such stock is perfectly free.

If suspicious, one can fumigate the stock when received with hydrocyanic acid gas as a precaution. This process is described under Remedies.

It is not intended to do injury or injustice to the nurseries of any section or to advertise the advantages of those of other sections; the facts are presented solely with a view to protect the fruit interests of Missouri. It is easier to keep the San Jose scale out of our orchards than it is to get rid of it when it is once introduced.

## FOOD PLANTS.

Unfortunately the San Jose scale will live and multiply on a great variety of plants, but especially on deciduous fruit trees and bushes, and also on many shade trees and ornamental shrubs. It infests the limbs, twigs, leaves, and fruit. The fruit trees more liable to be attacked are the pear, plum, peach, apple, cherry, and quince. It is strange that, although the pear is a favorite food plant, certain varieties sometimes appear more or less exempt, namely, Lecont and Kieffer. Japanese plums are said to be more subject to the attack of this scale than are the American varieties.

The following is a list of the food plants as given by Dr. L. O. Howard and Prof. F. M. Webster: Apple, Pear,

Quince, Plum, Cherry, Peach, Apricot, Currant, Gooseberry, Raspberry, Rose bushes, Almond, Linden, Enonymus, Spiraea, Hawthorn, Cotoneaster, Flowering Quince, Flowering Currant, Persimmon, Acacia, Elm, Osage Orange, English Walnut, Pecan, Alder, Black Walnut, Weeping Willow, Laurel-leaved Willow, Grape, Sumac, Flowering Peach, Flowering Cherry, Birch, Poplar, Catalpa, Chestnut, Snowball.

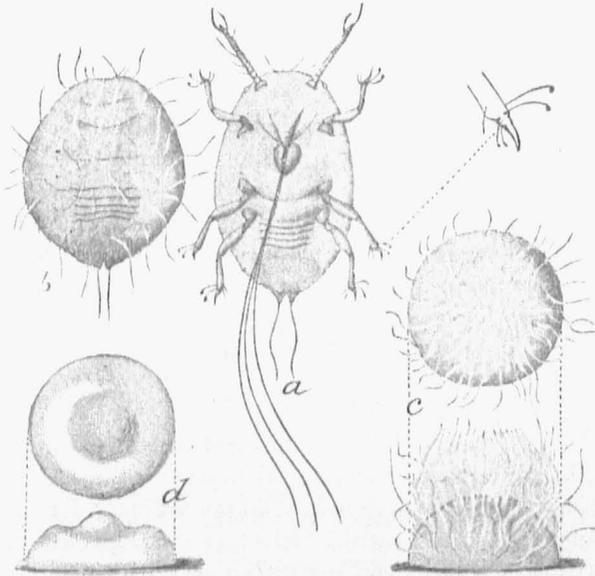


Fig. 5.—San Jose scale—young larva and developing scale; a, ventral view of larva showing long sucking beak; b, dorsal view of same, somewhat contracted, with the first waxy filaments appearing; c, dorsal and lateral view of same further developed; d, later stage of same, showing matting of wax secretions to form young scale. (From Howard and Marlatt, Bulletin No. 3, N. S. Division of Entomology, United States Department of Agriculture.)

#### DESCRIPTION OF THE INSECT.

The San Jose scale belongs to the same sub-family (Diaspinae) to which the common Oyster-Shell Bark-Louse (*Mytilaspis pomorum*) of the apple belongs. It is easily distinguished from the latter, however, by the fact that the San Jose scale is perfectly round or circular, or at most, slightly irregular, while

the Oyster-Shell Bark-Louse is two to three times as long as wide. The San Jose Scale is flat, very slightly raised in the center, and is applied close to the bark, which it resembles more or less in color. The full grown scale is grayish with a small black or yellowish central spot, and is about one fourteenth of an inch in diameter. As most of the scales on a limb are not full grown, the general appearance is that the scales are very much smaller. The young scales are dark colored, sometimes appearing almost black. (See figures.)

When occurring in large numbers on a limb or twig, the scales are crowded together, and frequently overlap one another. At such times they are not as readily detected, since they completely hide the natural color of the bark, and give the whole a grayish appearance as if covered with ashes. When not so thick on the limb, the difference between the color of the bark and that of the scales is more readily detected.

Healthy living scales may be detected by crushing them by means of the finger nail pressed tightly and drawn along the limb, when a yellowish oily liquid will appear.

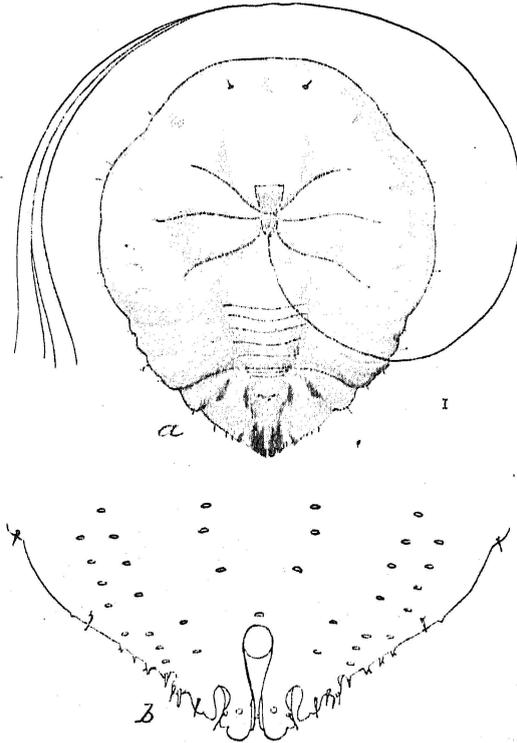
#### LIFE HISTORY OF THE INSECT.

The full grown scales that appear to the naked eye are the protective secretions which, in connection with the exuviae, cover the minute female insect. To the ordinary observer, the naked female is never seen. She is, in the adult state, much smaller than the scale, and is simply a sack with an enormously elongated beak or sucking tube. This tube is her mouth-parts, and is inserted into the plant from which her nourishment is drawn. She has no legs, antennae, eyes or wings, and can not move. The adult male insect, on the contrary, has well developed legs, antennae, eyes and wings, and flies about in search of females. The ordinary observer, however, never sees him since he is so extremely minute.

During the winter the San Jose scale can be found hibernating in a nearly full grown condition. In the early spring the hibernating males appear, and later, during May, those females that have lived through the winter mature and give

birth to living young. They continue to thus produce young lice for six weeks.

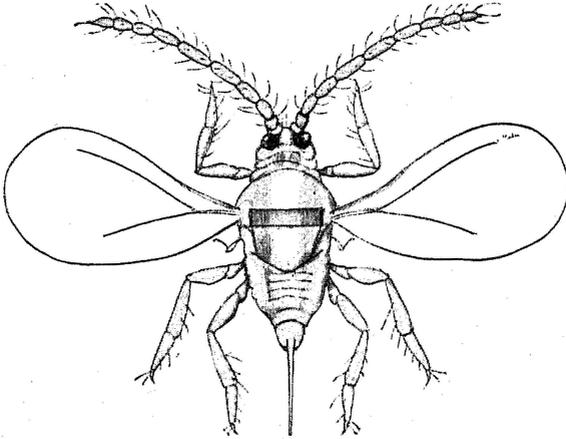
The young are extremely minute, and unless one is an expert and has good eyes, they will not be seen without a magnifying glass. They are yellow in color, oval in shape, and have



*Fig. 6.—San Jose scale—adult female removed from scale before development of eggs: a, ventral view, showing very long sucking setae; b, anal plate, showing characteristic ornamentation of edge—greatly enlarged. (From Howard and Marlatt, Bulletin No. 3, N. S. Division of Entomology, United States Department of Agriculture.)*

six legs by means of which they crawl about over the plant in search of a suitable place in which to insert their long sucking beak. They are, fortunately, active for a few hours only, when they insert their beak through the bark and begin to suck

the juice of their host. The young males and females look exactly alike, and behave alike. If the young is to become a female, it never leaves this place, but soon secretes a scale and, losing its legs and antennae, is forever stationary. If the young is to become a male, it secretes a scale and loses its legs and antennae for a time, but eventually regains them and also a pair of wings and eyes, and then emerging, leads an active life.



*Fig. 7.—San Jose scale—adult male—greatly enlarged  
(From Howard and Marlatt. Bulletin No. 3, N. S. Division  
of Entomology, United States Department of Agriculture.)*

There are at least four generations each season in this latitude; and as each female continues to give birth to living young for a period of about six weeks, it follows that we are able to find the insect in all stages of development during the entire summer, since the different broods overlap.

The males reach maturity in twenty-four to twenty-six days from birth, and the females in thirty-three to forty days. Each female gives birth during its six weeks of productiveness to about four hundred and forty-six female and one hundred and twenty-two males, according to Dr. L. O. Howard.\* That would give us as the total progeny for one summer,

\* U. S. Department of Agriculture, Bulletin 3, N. S. and Circular 3, SS. Division of Entomology.

resulting from the wintering of a single female, 1,608,040,200 females or 3,216,080,400 males and females. Of course this estimate is based on the supposition that all young live. In reality not all young ever reach maturity, but the greater number of them do, no doubt, in favorable seasons. These figures will give one some idea of how rapidly these minute scale insects multiply, and thus make up in numbers what they lack in size. It also explains why they are found in such quantities on infested trees, and eventually cause the death of the plant attacked.

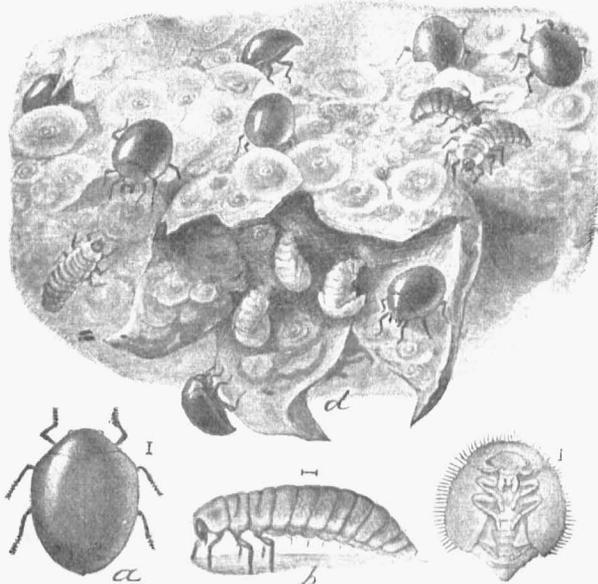
#### HOW IT SPREADS.

The San Jose scale is carried long distances by being brought into the orchard on fruit trees purchased in infested regions. This is the method by which it is distributed over large and isolated sections. Fruit sold at our fruit stores and stands, especially California fruit, frequently has the San Jose scale upon it; but the chances are not great that these insects will ever reach a place where the young can find nourishment and live, since, fortunately, the young are active traveling insects for only a few hours. They never travel more than a few feet when, unless they obtain food, they perish.

The scale, when once in an orchard or locality, spreads from one tree to another and from one field to another by means of the young active ones. They crawl upon the feet of birds, and upon other insects that are always alighting in trees, and are thus conveyed to other trees and localities. They may also be carried by other animals and even by wagons; but not to as great an extent as by birds, ants, and winged insects. The importance of birds as distributors of this insect can not be too strongly impressed upon the fruit grower.

In inspecting orchards in the neighborhood of infested ones, I have been in the habit of first looking for bird nests, which are easily seen when the leaves are off the trees, and I rarely fail to find at least the limb supporting the nest to be infested; and it is frequently the only infection found in the orchard.

The young probably never of themselves crawl on the ground to neighboring trees, unless the trees be very near together, as in the nursery. They will, however, crawl from one tree to another with absolute certainty if the limbs connect or overlap. This is the very best means of contamination, and one should make sure that, in an infested orchard, no limb of one tree touches a neighboring tree.



*Fig. 8.—Blossom end of pear, showing San Jose scale, with larvae and adult "Lady-Bugs" (Pentilla) feeding on them. a, adult beetle; b, larva; c, pupa. All enlarged. Lady-Bug beetles are beneficial insects and should not be molested. (From Howard and Marlatt. Bulletin No. 3, N. S. Division of Entomology, United States Department of Agriculture.)*

#### PRECAUTIONS.

Guard against procuring stock from infested regions.

Let everyone who has purchased stock from the infested regions (see localities previously given) within the past five years examine such trees carefully; and if suspicion is aroused, cut off portions of the infested limb and mail it to the Entomo-

logical Department of the Station, together with your name and address, the kind of tree on which found, and, if possible, the extent of the damage and the source from which the stock was purchased. This is, in all cases, the safest plan to follow, since you will thereby avoid all risks. In publishing reports of such examinations no names are used without permission, except cases in which parties are knowingly and willfully perpetrating a fraud.

#### REMEDIES.

Considering the exposed condition of the insect, and the ease with which remedies can be applied to it, the San Jose scale is perhaps the most difficult insect to kill that we have to deal with. Ordinary kerosene emulsion, so destructive to most scale insects, will not kill this insect except in its very early stages as young active lice; later the scale seems to protect them from injury. It is therefore necessary to resort to more powerful remedies.

From experiments conducted in the East, it appears that the well known California remedies (resinous washes, etc.) are not equally suited to eastern conditions, and do not give as good results as other remedies. It is impossible to discuss, in this Bulletin, the merits of the different washes and other remedies used against this insect. It will suffice to give the following, which has been found to be the simplest and most effectual:

Cut down and burn all badly infested trees, since they are already so far gone and injured that it will not pay to try and save them.

Prune the other trees back severely and burn the cuttings. Then apply *thoroughly* by means of a force pump and spray nozzle or by a whitewash brush, or both, as the case may require, *whale-oil soap* dissolved in water in the proportion of two pounds of the soap to one gallon of water. Give the trees a good drenching on all sides so as to completely cover every portion of the tree above ground, and repeat the process if it rains within a week after the spraying.

Three applications should be made, and two are absolutely essential.

The best time to apply the soap is in the fall, just after the leaves have fallen, and before the scales have become hardened, and again in the spring, just before the buds swell, and, if possible, once during the winter also. If but two applications can be made, the fall and spring applications are the essential ones.

Do not use whale-oil soap for San Jose scale while the trees are active or leaved out, since it is apt to kill them.

The use of washes during the summer is of practically no economic value, since the young lice are hatching continuously. This would necessitate sprayings every third day for two months. The expense of such a treatment would be too great. The young San Jose scale, not over two days old, is easily killed by ordinary washes, and if it were not for the continual appearance of the same, the insect would not be especially troublesome.

Old trees and all others that have rough scaly bark should be cut down and burned if infested with the scale, since it is impossible to reach and kill the scales that are protected under such rough bark.

Be sure and use *whale-oil soap* and not ordinary soap. If whale-oil soap can not be had, fish-oil soap can be used, but not with as good results. Whale-oil soap can be purchased from any large drug firm. It costs about four cents per pound.

The only objection to the application of this wash is that the trees are liable to either not bloom at all or to bloom very little the first season, but they will make up in an increased development of foliage and vigorous growth of the tree.

From our experiments in Missouri it is evident that whale-oil soap used as directed will completely exterminate the San Jose scale on the trees thus treated.

Nursery stock that is infested with the San Jose scale should be burned; while stock that might possibly be slightly infested by being grown near (one mile or less) regions that are infested, should be fumigated as a precaution, even though

no scales are detected on such stock. The nature of the scale renders it impossible to make a complete inspection and detection of the pest in nursery stock, and hence the necessity of a thorough fumigation. The fumigation should consist of *hydrocyanic acid gas* generated in a tightly closed box or room in which the stock is placed.

The following is a reliable plan: Select or have made a tight room or large box and place the nursery stock in it, filling it up if necessary, and then generate the hydrocyanic acid gas by placing in an earthen bowl two parts sulphuric acid mixed with six parts water, put this in the box or room, and, when all is ready, drop one part cyanide of potassium in the bowl of weak acid and close the door immediately. Of course the door should fit tightly so that no gas (to amount to anything) can escape. Every precaution should be taken not to breathe the gas, since it is extremely poisonous. Leave the plants under the influence of the gas for one half to three quarters of an hour.

The proper amount of the ingredients required depends on the size of the room or box, but it is safe to say that one ounce of the cyanide of potassium should be used for every 150 cubic feet of the room space. For instance, a room ten feet by ten feet by six feet would contain 600 cubic feet, and, after the nursery stock is in, the bowl should be supplied with eight ounces of sulphuric acid and twenty-four ounces of water, stirred together, and, when all is ready, four ounces of cyanide of potassium should be added.

Open and air the room before entering to remove the plants.

We are indebted to the following railroads for material assistance in carrying on the work of inspecting orchards: Kansas City, Fort Scott and Memphis R. R. Co., St. Louis and San Francisco R. R. Co., Hannibal and St. Joseph R. R. Co., St. Louis, Keokuk and Northwestern R. R. Co., Kansas City, St. Joseph and Council Bluffs R. R. Co., and the Chicago, Burlington and Kansas City R. R. Co.