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THE SAN JOSE SCALE IN MISSOURI.

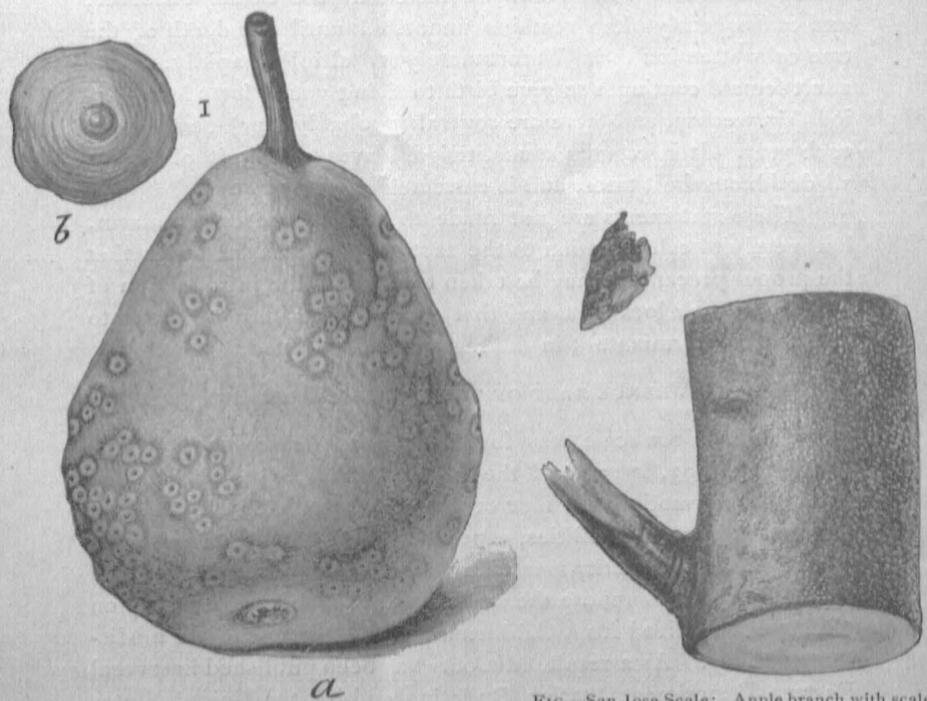


FIG. 1.—San Jose Scale; *a*, pear, moderately infested—natural size; *b*, female scale—enlarged.

FIG.—San Jose Scale: Apple branch with scales in situ—natural size; enlarged scales above, at left.

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.

IMPORTANCE OF THE INSECT.

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 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 in new localities, and that every effort may be made to detect and exterminate it in the regions now infested.

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 through the agency of a Missouri nursery. As a result, Missouri has been published 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 Eastern Virginia, Maryland, Delaware, Southeastern New York, Southeastern Pennsylvania, Massachusetts, Ohio, Southern Indiana, Georgia, and is found in Florida, Alabama, Louisiana, New Mexico, Washington, Oregon, Idaho, and, of course, California.

From investigations conducted this spring by this station, it is evident that Missouri is not responsible for this introduction, since none of the stock from California on which the scales were supposed to have been, was planted in Missouri; it simply passed through one of our nurseries, acting as agents, 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.

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. All suspected ones were visited and carefully examined. The results are briefly, as follows:

Missouri is not, so far as we can find, responsible for the introduction of the San Jose scale in the East (New Jersey nurseries).

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.

Only one orchard in the state is known to have been infested with the San Jose scale, and that to the extent of but six trees which have already been dug up and burned. These six trees were purchased from a New Jersey nursery and had been in the state less than two years.

SOURCES OF INFESTATION.

California is, of course, a locality from which infested trees may be obtained at any time, since the scale has been established for many years in every fruit-growing section of the state. For this reason, which is generally well known, fruit growers have been cautious about obtaining stock from California, and when obtained there, have subjected it to close inspection. The great

danger of introducing the scale is in obtaining stock from the unsuspected regions recently infested. It is now well known that two large New Jersey nurseries were badly infested, and had innocently distributed infested stock broadcast for some six years. Nearly all the eastern occurrences of the scale have been traced directly or indirectly to this source of infection. Many eastern nurseries, as well as orchards, became infested before the San Jose scale was supposed to be in the East. When the San Jose scale was discovered there, and attention was called to it, many infested localities were found; and it is now known that no less than fourteen states east of the Rocky mountains contain infested sections. The states containing the greater number of infested localities are named above.

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 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.

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 are nearly always 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: Linden, Euonymus, Almond, Peach, Apricot, Plum, Cherry, Spiraea, Raspberry, Rose, Hawthorn, Cotoneaster, Pear, Apple, Quince, Flowering Quince, Gooseberry, Currant, Flowering Currant, Persimmon, Acacia, Elm, Osage Orange, English Walnut, Pecan, Alder, Weeping Willow, Laurel-leaved Willow.

DESCRIPTION OF THE INSECT.

The San Jose scale belongs to the same sub-family (Diaspidinae) 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 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.

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.

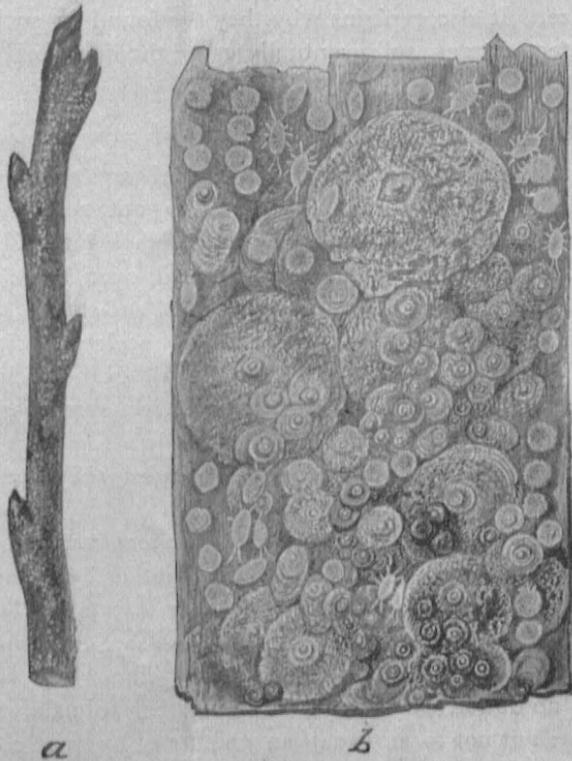


FIG. 3.—Appearance of scale on bark; *a*, infested twig—natural size; *b*, bark as it appears under hand lens, showing scales in various stages of development and young larvae.

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. Howard. That would give us as the total progeny for one summer, 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 infected trees, and eventually cause the death of the plant attacked.

HOW IT SPREADS.

So far as the fruit interests of Missouri are at present concerned, the San Jose scale will probably not reach us unless brought into the state 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 other insects that are always alighting in trees, and are thus conveyed to other trees and localities. I believe this is the chief natural method of distribution. They are, no doubt, carried by birds and other animals, and even by wagons; but not to as great an extent as by winged insects. 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 limbs of one tree touch a neighboring tree.

PRECAUTIONS.

Guard against procuring stock from infested regions.

Let every one who has purchased stock from the infested regions within the past four years, especially from New Jersey and Maryland nurseries (see other localities previously given), examine such trees carefully; and if suspicion is aroused, cut off portions of the infested limb and mail it to me, together with your name and address, the kind of tree on which found, and, if pos-

sible, 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.

REMEDY.

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 are not equally suited to eastern conditions, and do not give as good results as other remedies. It is impossible to discuss, in this brief circular, 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:

Use Whale-Oil Soap, dissolved in water in the proportion of two pounds of the soap to one gallon of water. Apply thoroughly by means of a force pump and spray nozzle. Give the trees a good drenching on all sides, and repeat the process if it rains within a week after the spraying.

The best time to apply the wash is in the fall, just as the leaves are dropping or have just fallen, and before the scales have become hardened, and again in the spring, either just before or while the trees are blooming.

The use of washes during the summer is of practically no economic value, since the young lice are hatching continuously. This would necessitate repeated 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.

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.

The Whale-Oil Soap used as directed should completely exterminate the San Jose scale on the trees thus treated in Missouri.

We are indebted to the Entomological Division of the United States Department of Agriculture for the illustrations used in this circular.

J. M. STEDMAN,
Entomologist.