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UNIVERSITY OF ILLINOIS,
Agricultural Experiment Station.

URBANA, APRIL, 1897.

BULLETIN No. 48.

THE SAN JOSÉ SCALE IN ILLINOIS.*

IMPORTANCE OF THE SAN JOSÉ SCALE.

“There is perhaps no insect capable of causing greater damage to fruit interests in the United States, or perhaps the world, than the San José, or pernicious, scale. It is not striking in appearance, and might often remain unrecognized, or at least misunderstood, and yet so steadily and relentlessly does it spread over practically all deciduous fruit-trees—trunk, limbs, foliage, and fruit—that it is only a question of two or three years before the death of the plant attacked is brought about, and the possibility of injury, which, from experience with other scale enemies of deciduous plants, might be easily ignored or thought insignificant, is soon startlingly demonstrated. Its importance from an economic standpoint is vastly increased by the ease with which it is distributed over wide districts through the agency of nursery stock and the marketing of fruit, and the extreme difficulty of exterminating it where once introduced, presenting, as it does in the last regard, difficulties not found with any other scale insect. Its importance was early recognized by Professor Comstock, who in first describing it in 1880 gave it the suggestive name of *perniciosus*, saying of it that it is the most pernicious scale insect known in this country. The Los Angeles Horticultural Commission reported in 1890 that if this pest be not speedily destroyed it will utterly ruin the deciduous fruit interests of the Pacific Coast. Its

*This article is based upon a paper read by the writer to the State Horticultural Society at its meeting in Springfield, Ill., Dec. 30, 1896.

capacity for evil has been more than demonstrated since its appearance in the East, and it has been, if anything, more disastrous to the peach and pear orchards of Maryland, New Jersey, and other Eastern and Southern States than in California and the West.

"We are therefore justified in the assertion that no more serious menace to the deciduous fruit interests of this country has ever been known. There is no intention here to arouse unnecessary alarm, but merely to emphasize the importance of taking the utmost precautions to prevent its introduction into new localities, and to point out the extreme necessity of earnest effort to stamp it out where it has already gained a foothold."

The foregoing sentences are from a bulletin on the San José scale published in 1896 by the United States Department of Agriculture.* Its authors, Messrs. Howard and Marlatt, have been for a long time in the Division of Entomology, at Washington, Mr. Howard being now its Chief; and they have thus for many years been made continuously acquainted with the history and spread of this scale, have personally studied it at many different localities, and have obtained information concerning it from all parts of the United States infested by it. No one else can speak with such authority on the subject of its injuries to horticulture, and few are less likely to make extreme or sensational statements concerning it.

My own brief experience with it fully bears out, as far as it goes, the statements above quoted. For example, a single orchardist in this State has already lost a thousand trees, killed by this scale, notwithstanding very considerable efforts on his part to dislodge it, and his present orchard property of some seven hundred trees is all thoroughly infested. From this place, near Sparta, in Randolph county, the pest has overflowed into surrounding orchards, and has possibly been distributed elsewhere, no one knows how far nor in what amount. Furthermore, observations made within the last year in Delaware† seem to show that this scale is much more difficult to eradicate and that it tends to spread more rapidly than has heretofore been supposed. The Experiment Station Entomologist of that State reports that where he found but fifty infested trees last year he now finds a thousand, although energetic insecticide measures have been taken in the meantime; and he further concludes that the entire orchard must be thoroughly treated in every case where even so much as a single tree is found visibly infested.

* "The San José Scale; its Occurrences in the United States, with a full Account of its Life History and the Remedies to be used against it."

†Bull. XXXIII., Del. Agr. Exper. Station.

When to this general report of injuries done by this scale insect elsewhere I add the ominous statement that we have found within the last seven months fifteen widely separated localities in Illinois upon which the San José scale has securely fastened itself and from which it is certain to spread in all directions if not checked or exterminated where it is, it will be clearly seen that we have to deal with a first-class emergency in the history of horticulture in this State; one which calls for wisdom in counsel and energy in action as few other things have done since horticulture first began to assume prominence among us as an industrial pursuit.

DESCRIPTION.

The female of the San José scale—so named because it was first detected in the San José Valley of California—is a small, nearly flat, circular scale, from a twelfth to a twenty-fifth of an inch in diameter, of a general gray color (light or dark) with a pale yellow or reddish yellow center. The surface of the full-grown scale is usually smooth, but is sometimes slightly marked with concentric rings. The scale of the male is oblong when full grown, usually darker than that of the female, sometimes approaching black. It is marked by a nipple-like elevation near one end, surrounded by a little groove-like ring, which gives it a very characteristic appearance under a good hand lens.

The surface of the bark, when it is completely covered, has to the naked eye a minutely roughened, incrustated, and unhealthy look, and a dusky or dark grayish hue. If the surface be rubbed by the finger, it will have a greasy feel, due to an oily fluid from the crushed insects. Examined under a good glass, the nipple-like centers of the young scales and the circular grooves surrounding these give a very characteristic appearance to the encrusted surface. From other common fruit scales it is very readily distinguished, especially in the winter, by its circular form, by its smaller size, and by the absence of eggs beneath it. The other common apple scales are the oyster-shell bark-louse and the scurfy scale, both of which are oblong, varying in length from a tenth to a sixth of an inch. Under each scale of these species will be found at this season a little collection of oval eggs, yellow or nearly white under the oyster-shell scale, and maroon-red under the scurfy scale. The San José scale, on the other hand, does not commonly lay eggs, but brings forth its young alive.

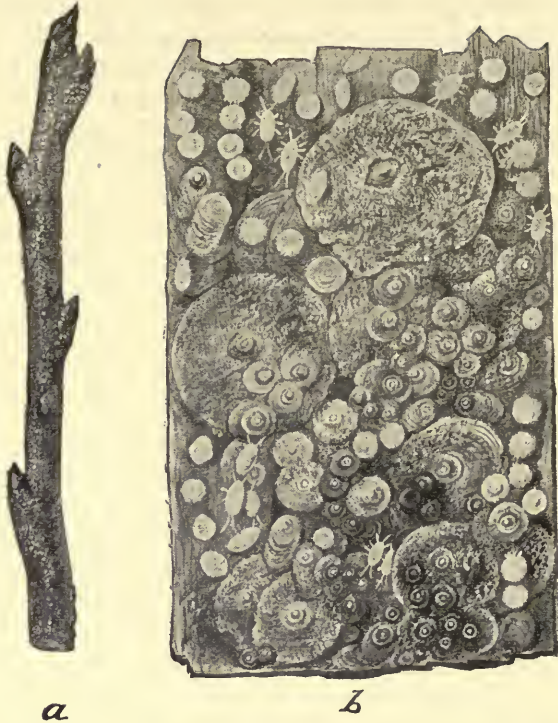


Fig. 1.*—San José scale on bark: *a*, infested twig, natural size; *b*, small portion, magnified.

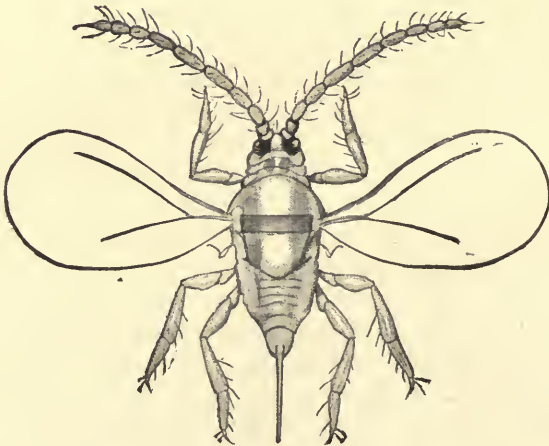


Fig. 2.*—Adult male, greatly enlarged.

*From Bull. No. 3, N. S., U. S. Department of Agriculture, Division of Entomology pp. 36 and 42.

LIFE HISTORY.

This scale passes the winter, nearly grown, as a living insect on the bark. By the middle of May the young begin to appear—minute six-legged oval creatures, visible under a lens as crawling yellowish specks. After creeping about for a few hours, the young insect thrusts its long bristle-like sucking beak through the bark of the plant and there remains motionless during the remainder of its life. It gradually transforms by successive molts to the circular scale already described, all trace of legs and feelers disappearing in the process. This account of its transformations applies to the female only, the male going through a somewhat different process, and emerging as a minute two-winged fly. When a little more than a month old the female begins to bring forth young, at least four successive generations occurring in our latitude in a single season. The progeny of a single female may vary, according to actual count, from fifty to five hundred or more, with an apparent average of about two hundred female young for each female of the generation preceding. According to these figures the production of a single female insect surviving the winter on the bark would amount by fall to over a billion and a half of female scales. "It is not to be expected, of course," says Mr. Howard, "that all the individuals from a scale survive and perform their function in life, but under favorable conditions, or in the case of a tree newly infested or not heavily incrustated, the vast majority undoubtedly go through their existence without accident. 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."

FOOD PLANTS.

The San José scale attacks nearly every variety of deciduous fruit trees, and many other trees and various shrubs as well. It has been found upon the peach, apricot, plum, cherry, pear, quince, raspberry, rose, gooseberry, currant, persimmon, elm, osage orange, pecan, linden, willow, and wahoo. The pear, peach, plum, apple, and cherry are almost equally liable to injury. Certain varieties of pear are, however, rarely attacked, notable examples of which are the Leconte and Kieffer, both supposed to be hybrids with the Chinese sand pear. On Mr. Hayer's premises at Sparta Kieffer pears remain uninjured, scattered here and there through an orchard where almost every other tree is thickly incrustated. The liability of this scale to extend to osage orange hedges is a fact which must be especially borne in mind, since it often makes

it necessary to treat the fences surrounding an orchard as a part of the orchard itself. Whatever tree it attacks it is likely to infest throughout, fastening itself indifferently upon trunk, limbs, leaves, and fruit. It sometimes kills the tree outright, although badly infested stock may maintain a feeble existence for some years. Young peach-trees will ordinarily survive an attack of this scale two or three years at most. If left to itself it spreads quite slowly, killing, however, as it goes, everything particularly subject to its attack. It is possible that the young scale may be conveyed to considerable distances by flying or running insects or by birds; ordinarily, however, such scattering of the young scale will have no permanent effect, since females distributed here and there, one in a place, would be little likely to be fertilized, and in most cases would perish without reproduction. I have lately received, however, from Professor J. M. Stedman, of Missouri, an interesting item of information touching upon the agency of birds in the distribution of this scale. In the vicinity of infested orchards in Missouri Professor Stedman noticed that wherever a bird's nest was seen the San José scale had commonly established itself, sometimes, indeed, being confined to the branch bearing the nest, in other cases having distributed itself more generally over the tree. Evidently the frequent passage of birds between the nest and the infested orchard had resulted in the frequent transfer of the young, probably including males and females both, and in the establishment of colonies in condition to perpetuate themselves and to serve as further centers of distribution.

ORIGIN AND DISTRIBUTION.

The original home of the San José scale has not yet been certainly ascertained. It has been found in Australia, Japan, and Hawaii, but seems to have been first recorded from Chili in 1872, where it was found on pears which had been introduced from the United States. By 1873 it had become a serious pest in the San José Valley, California, on the premises of Mr. James Lick, the founder of the Lick Observatory. It was not scientifically described until 1880, by which time it had extended as far west as San Francisco. It has since spread, in the Pacific region, throughout California, Oregon, and Washington, and has reached British Columbia and Idaho on the north, and Nevada, Arizona, and New Mexico on the south. Its first appearance in the Atlantic States, so far as known, was on plums imported to New Jersey from San José in the spring of 1886 or 1887. It was not actually detected in these states, however, until August, 1893, at which time it was found in Charlottesville, Virginia, where it had been introduced

from New Jersey nurseries. Besides the states above mentioned, it is now known to occur in Alabama, Delaware, Florida, Georgia, Indiana, Louisiana, Massachusetts, Maryland, New York, Ohio, Pennsylvania, West Virginia, Missouri, and Illinois.

The first publication of its occurrence in the East was made by Riley and Howard in February, 1894, and in April of that year twelve thousand copies of a circular of warning were issued by Mr. Howard, giving general notice of its occurrence in several Eastern States.

PRECAUTIONARY MEASURES IN ILLINOIS.

Apprehensive lest it should already have made its way to Illinois through importations either direct from California or from Eastern States, and fully appreciating also the probability, the practical certainty, indeed, that it would at any rate ultimately appear in our own orchards, the general subject of the scale insects of the State was assigned in July of this same year, 1894, to Mr. W. G. Johnson, an assistant of my office recently engaged from California, where he had become well acquainted with the San José scale. During the two following years numerous collections of the orchard scales were made in various parts of the State. A paper on this subject was prepared for the Transactions of the State Horticultural Society,* and a technical article containing descriptions of some new species detected in the course of Mr. Johnson's studies was prepared by him for publication in the Bulletin of the State Laboratory of Natural History.†

During all this work, although it is now evident that the San José scale was present in the State at the time in several localities, not a single specimen was found by us—a sufficient proof, if any were needed, that it is virtually impossible to detect such first appearances by means of a general and indiscriminate search conducted without clues to probable places and times of introduction.

DISCOVERY IN ILLINOIS.

The first hint of the presence of the San José scale in Illinois was received August 29, 1896, from Mr. Chittenden, an Assistant in Mr. Howard's entomological office in Washington, in charge of the office during the absence of his Chief, who wrote enclosing a letter from Dr. Groff, of Lewisburg, Penn., reporting that he had just received from Mr. Valentine J. Kiem, of Quincy, Ill., the San José scale "in its worst form," and asking that the Entomologist of this State be notified. I later learned from Mr. Kiem that this report was based on specimens sent by him, with a request for information, to Meehans' "Gardeners' Monthly."

* Vol. 23, 1894, p. 170.

† Art. XIII., Vol. IV., p. 380.

I immediately wrote to Mr. Kiem for specimens cut from the injured trees, and September 4th received from him pieces of twigs completely incrustated with the San José scale. The fact of the occurrence of this insect in Illinois being thus established, I sent my most experienced Entomological Assistant, Mr. C. A. Hart, to Quincy with instructions to inspect the infested premises thoroughly, and to extend his search into all orchards, nurseries, and fruit gardens for two or three miles around. According to his report, made September 9th, the Quincy attack was limited to about a dozen peach- and apple-trees received from a New Jersey nurseryman in the spring of 1894, and set in an isolated orchard of five hundred trees some three miles out of town.

DISINFECTION OF QUINCY ORCHARD.

At a meeting of the Executive Board of the State Horticultural Society, held in September, 1896, the facts with regard to this orchard were reported to this Board, who thereupon passed a resolution requesting the State Entomologist to undertake the extermination of the scale at this place, and making an appropriation (not to exceed \$150) from the funds of the Horticultural Society for the expenses of this procedure.

On a personal visit to Mr. Kiem's place, made a few days later, I came to an agreement with him that he should permit nothing to leave his premises which could possibly convey the scale to any other locality, and that he should do all the work and provide all the assistance necessary to a thorough insecticide treatment of everything on his farm which could harbor the scale, on condition that the work should be supervised from my office and that the insecticide should be furnished him at our expense. As the female scales were still giving birth to young at this time, I decided to postpone operations until it was certain that all the scales in the orchard were established in fixed position on the trees. There was an additional advantage in waiting until the leaves had fallen, as a smaller quantity of insecticide would then be required for a thorough treatment of the trees, shrubs, and hedges on this place.

As Mr. J. C. Blair, of the University Department of Horticulture, has had extensive practical experience with spraying methods in the orchard, I gladly availed myself of his kind offer to superintend this operation for us, and sent him November 10th on a general trip of inspection through western Illinois, with full instructions as to the disinfection of the Quincy orchard. The insecticide used was whale-oil soap obtained from Leggett & Brother, 301 Pearl Street, New York City, at a cost of four cents

per pound by the barrel. This soap was applied in a hot solution of two pounds to the gallon of water. In the operation a large iron pot holding about sixty gallons was mounted in the field near the orchard, and in it water was heated and the soap dissolved. This soap solution was taken from the pot boiling hot and placed in a barrel on a wagon provided with an ordinary orchard spray-pump and twenty-five feet of hose with a good spray nozzle. Three men were required for the work: one heating the water, one driving the team and pumping, and the third handling the hose. Nine of the infested trees had been rooted up and burned by the owner, but everything else in the orchard was thoroughly drenched. Care was taken that every twig of every tree was thoroughly soaked with this hot solution, which was, however, doubtless cold by the time it struck the bark. The trees were carefully examined the next day after spraying, and all parts which the liquid had not certainly reached were sprayed again. Patches of raspberry canes adjoining and all the osage-orange hedge in the vicinity were similarly treated. Five hundred and ninety-five pounds of whale-oil soap were thus used, or a total of two hundred and ninety-eight gallons of fluid for the five hundred trees. The one- and two-year-old stock required but little of the solution, but for trees four to eight years old an average of two and a half quarts was used. For some of the larger trees in the older part of the orchard two gallons each were necessary. Mr. Blair found it expedient to direct the spray himself, not wishing to trust to the thoroughness of persons not familiar with this sort of work. The cost of material for this single treatment was \$23.80. For the larger trees it was, as will be seen, eight cents per tree for the soap alone.

INSPECTION OF ILLINOIS ORCHARDS.

Learning from Mr. Kiem that other trees had to his knowledge been received from New Jersey by his neighbors at about the same time as his own, I decided to appeal to the public spirit of these outside nurserymen known to have distributed stock at a time when their own premises were infested and before this fact had been ascertained by them, in the hope of securing from them lists of their Illinois customers to whom this suspected stock had been sent out. By correspondence with Professor J. B. Smith, the Experiment Station Entomologist of New Jersey, I secured the names of all nurserymen in that State whose premises had at any time been infested with the San José scale and who had an outside trade in nursery stock. To my great pleasure, these gentlemen were good enough to send me lists of purchasers in Illinois

to whom it seemed to them possible that infested trees or shrubs had at any time been sent. The total number of Illinois localities given on these lists was one hundred and nineteen, and the number of persons receiving stock from these suspected localities was one hundred and forty-six in all. These localities were well distributed throughout the State, from Waukegan and Scales Mound on the north to Villa Ridge on the south, and from Paris and Danville on the east to Moline, Quincy, and Alton on the west. To all persons who had imported this suspected stock a letter of warning and advice was sent from my office October 22, with a request that careful inspection of this material should be made, and that specimens should be sent me if anything of a suspicious character was found. General notice of the facts was also published through the agricultural press of the State and through the Associated Press.

October 20th I began to visit, either personally or through competent assistants, the places on our list, with the intention of looking up and inspecting critically every lot of imported stock which we had reason to believe might possibly harbor the scale. Ninety-eight localities and one hundred and thirteen orchards and nurseries have been visited up to this date, with the result to discover, as already said, fifteen points in Illinois now known to us to be infested by the San José scale. At each of two of these we found two independently imported lots of trees which were infested, making seventeen such importations thus far found in Illinois. These infested localities are as follows, beginning at the north part of the State: Monroe Center, in Ogle county; Tremont, in Tazewell county; Quincy and Paloma, in Adams; Auburn and New City, in Sangamon; Tower Hill, in Shelby county; Ernst, in Clark county; Collinsville, in Madison county; Mascoutah, in St. Clair county; West Salem, in Edwards county; Mt. Carmel, in Wabash county; Richview, in Washington county; Sparta, in Randolph; and Villa Ridge, in Pulaski county. Availing myself of the Holiday dispersion of our entomological students to their homes, and putting two inspectors besides into the field for regular trips, I have now been able to provide for visits to nearly all the other points requiring inspection.

CONDITIONS AT INFESTED LOCALITIES.

The exact condition of affairs with respect to this scale reported by my inspectors for each of the orchards now known to be infested by it is as follows:

At Monroe Center, in Ogle county, one pear-tree in a small fruit patch was found badly infested with the scale, the other trees in the lot being, so far as could be seen, entirely free from it.

This infested tree had come from a New Jersey nursery. To my letter of October 22d, asking him to inspect his imported trees and to report the results, the owner had replied that he had carefully examined all his New Jersey stock, and that it was free from scale. I mention this as evidence of the fact that the fruit grower's own inspection cannot be depended on with safety in matters of this importance.

Three miles south of Tremont, in Tazewell county, my inspector found that Mr. Jacob Winzeler had purchased from New Jersey in the springs of 1894 and 1895 a considerable number and a large variety of trees, mostly pears but including also a few apples, plums, and cherries, and some currant bushes. In this orchard six Japanese golden russet pears were quite badly infested by the scale. As these were set alternately with trees of other varieties which showed no sign of the scale it is practically certain that they were infested when received, and it is probable that the scale has not begun to spread. The owner has promised to burn these trees, but we have no present assurance that the remainder of the orchard will be sprayed.

The Quincy case has already been described. The other Adams county locality at which the scale was found was Paloma, a small town on the Wabash railroad. Among some forty or fifty New Jersey trees on the premises of Thomas P. Ogle at this place only one was found infested with the scale, and that a pear which stood by itself on the lawn. This was dug up and burned by Mr. Blair, and the owner of the orchard has promised to disinfect the remainder of his trees. As these are all small, it can be done at very slight expense.

At New City, in Sangamon county, twelve miles south of Springfield, three plum-trees and thirteen pears (Clapp's favorite and Garber) belonging to Mr. Henry Archer were badly infested with the scale. These trees were said by the owner to be grafts from a nursery at Louisiana, Mo., but as he had received many trees from New Jersey whose location he was not sure of, it seems probable, on the whole, that this was the source of the scale. The owner promised to root up and burn the trees marked for destruction by Mr. Blair, but did not feel that he could afford to disinfect his entire two-acre orchard with whale-oil soap.

At Auburn, in this same county, nineteen miles south of Springfield, we found five acres of fruit-trees belonging to Mr. I. N. Lowe, among which two plum-trees, eight apple-, eight pear-, and eleven peach-trees, all imported from New Jersey about five years ago, were found so badly infested by the San José scale that the owner was advised to dig them up and burn them. The

osage-orange hedge beside this orchard plot was also seriously attacked. It would probably require six hundred pounds of whale-oil soap to destroy the scale on these premises, together with a good force-pump, twenty feet of hose, and other appliances not now in Mr. Lowe's possession. To raise the fifty dollars or so which a thorough disinfection of this orchard would require, the owner assured us that he would have to haul corn to market at thirteen cents a bushel.

Two and a half miles east of Tower Hill, in Shelby county, we found two hundred New Jersey pear-trees and eight hundred others, together with apples, blackberries, etc., mostly from Illinois. Five of the New Jersey trees were badly infested by the scale, and three others slightly so. The owner, Mr. G. W. Grisso, promised to burn the infested trees.

From Ernst, in Clark county, twigs from a dwarf Duchess pear-tree bought in the spring of 1894 from a Bridgeport, Ohio, nursery, were sent me early in this month by Mr. William C. Hammerly with the request that I would identify the scale upon them, which had lately attracted his attention. These twigs were thoroughly incrustated with the San José scale, although a dozen dwarf pears bought at the same time, and fifty more received from the same source in the spring of 1895, together with a number of peach-, cherry-, and quince-trees, were reported to be perfectly clean. The infested tree, however, was incrustated from the surface of the ground almost to the tips of the twigs. Advised of the presence of the San José scale by my reply, Mr. Hammerly wrote me on the 10th of December that he had cut the tree down, sprayed it thoroughly with kerosene and burned it. As this tree came from a source not previously known to be infested by this scale, some correspondence followed, from which I learned that the tree came to this State through a jobber or dealer in trees who had no nursery of his own but who had bought it with a quantity of others from a New York nurseryman on whose grounds the scale has never been known to occur. On a subsequent careful inspection of this entire neighborhood no other infested trees were found.

At Collinsville, in Madison county, in an orchard of about five acres belonging to Charles Eckert, five or six large trees (apricot and plum) were found slightly infested at one end of the orchard, and a small apple near the center of it was extensively attacked by the San José scale and other orchard scales. The latter tree had been received from New Jersey three years ago, and had been noticed by the owner as unthrifty from the beginning.

At Mascoutah, in St. Clair county, about ten trees were found infested with the San José scale in one corner of a neglected fruit

plot on a town lot. The infested trees were peach, apple, and cherry. These had been imported originally from New Jersey by John Baisch. The property has since changed hands.

In a ten-acre orchard at West Salem, Edwards county, belonging to Mr. Augustus Fischel, several Nevada pear-trees originally obtained from a New Jersey nursery were found badly infested with the San José scale, one of the trees having, in fact, died from its effects. An apricot was also conspicuously covered, and a few peach-trees near by were slightly contaminated.

At Mt. Carmel, in Wabash county, a single infested plum-tree has been found, specimens from which were sent me by Dr. J. Schneck. Particulars have not yet been received.

At Richview, in Washington county, in a young eight-acre orchard, nearly all pears, belonging to Dr. J. W. Stanton, a large number of trees were found dead and completely covered with the San José scale, the greater part of the others in this plot being also more or less infested. A few scales were found even on the Kieffer pears, although none of these trees were seriously affected. A part at least of the infested trees were originally from New Jersey. From this place the scale has spread into an old orchard adjoining, belonging to Mr. Rice. A few San José scales were also found in a small pear orchard belonging to Jasper Welgur on stock from the same source as the preceding.

Much the most serious condition of affairs with respect to the San José scale thus far found by us is that disclosed by letters from Mr. J. B. Hayer, at Sparta, Randolph county, and by the subsequent report of an inspector from my office who visited his place last December. Mr. Hayer's New Jersey importations were made at various times from five to ten years ago, and since that period he has lost about a thousand bearing apple- peach- and pear-trees from this scale. He has now about seven hundred trees on his farm, all of which except his Kieffer pears are infested with the scale, many of them being completely incrustated. The same scale was found on this farm on elm trees, wild crab-apples, and rose bushes, and on osage orange hedges beside the orchard. It has also spread to three other orchards adjoining on the north, west, and south. Mr. Hayer has applied various insecticides from time to time, some of them with moderate success, but has practically given up trying to raise peaches and apples and buys now only the Kieffer pear. Another fruit-grower near this town, Mr. John Robinson, has also imported the scale from the same New Jersey situation, and has it now on peaches and on the Nevada pear.

From Villa Ridge, in Pulaski county, Mr. C. C. Spaulding sent me, the first of March, pieces of twigs from a Transcendent crab-apple-tree obtained from a tree dealer in Ohio in the fall of 1894, the condition of which had attracted his attention sufficiently to lead to his treating it with pure kerosene. An examination of these specimens showed that they were thickly covered with the San José scale. Further search by Mr. Spaulding, made upon the receipt of this information, resulted in the sending of several additional specimens bearing scale insects, none of which, however, were of this species.

It will be seen that these seventeen Illinois colonies of the San José scale are all in orchards or small fruit plots, and none of them in nurseries. In every case thus far detected the original importation of the scale was made directly from the East by the owner of the orchard, and not through any Illinois nursery. On the other hand, it is much to be regretted that although our local nurserymen have frequently dealt with proprietors of Eastern nursery grounds which are now known to have been at one time infested, my inspectors have rarely been able to trace any stock so received beyond the Illinois nursery through which it has passed to Illinois customers; it is consequently possible that some cases of the occurrence of the scale will thus escape our search. It is also worthy of remark that we have not thus far found any cases of infested premises where the scale has been introduced by trade with another infested point within the State. In every case the immediate start has come from outside our limits.

PREVENTIVES AND REMEDIES.

Methods of prevention applicable to the San José scale are limited to precautions against its introduction on to premises previously free. With the numerous possible sources of contamination now scattered throughout the country, no fruit grower is really safe who does not first assure himself that the premises from which his young stock may be obtained are themselves free from this insect, and who does not critically inspect every portion of every tree and shrub liable to attack by this scale which comes to his premises. The best evidence of the absence of the scale from any nursery is the general reputation of the nurseryman for care, method, and honesty, backed by a certificate of inspection from some competent entomological expert, presumably a state or national officer. The time seems rapidly approaching when official inspection and certification will be a necessity of the trade. It is to be remembered, however, that an inspection of the premises of a nursery and a certificate of freedom from the scale are not a

guarantee of all stock which may be shipped out by the owner, since a large percentage of that sold by most nurserymen originates elsewhere. The rearing of nursery stock has now become largely specialized in localities to the great advantage, indeed, both of the dealer and his customer. In any case in which the purchaser of young trees suspects the possibility of the presence of this scale he should at least thoroughly disinfect it by dipping or washing in a solution of whale-oil soap, to be presently described as the standard remedy for an attack. A great variety of remedial substances have been more or less generally used in different parts of the country, and have likewise been extensively treated experimentally by the U. S. Department of Agriculture in the vicinity of Washington. The results of these experiments indicate that conclusions reached and practices established on the Pacific slope cannot be depended upon in a widely different climate. At present, for practical purposes it seems wise to limit the recommendation of an insecticide to a solution of whale-oil soap, two pounds to a gallon of hot water, made and used as stated in this paper in the description of the Quincy experiment. The reader desirous of knowing the varieties of treatment and the results of experience with them cannot do better than to consult the bulletin on the San José scale published in 1896 by the U. S. Department of Agriculture, pages 56-71. From the summary of recommendations in this bulletin I take the following:

“For the East, experience justifies the following steps as of highest importance:

“(1) In all cases of recent or slight attack the affected stock should be promptly uprooted and burned. No measure is so sure as this, and the danger of spread is so great that this course seems fully warranted.

“(2) In case of long standing and wide extent the affected stock should be cut back severely and treated with winter soap wash. Stock badly incrustated with scale should be cut out at once and burned. The lessening of the vitality, together with the poisoning of the sapwood already affected by the scale in such cases, will usually prevent the plant from ever again becoming healthy, and generally it is beyond help. We wish particularly to impress upon the minds of fruit growers that as soon as this insect is found to occur in an orchard the most strenuous measures must be taken to stamp it out. No half-way steps will suffice. The individual must remember that not only are his own interests vitally at stake but those of the entire community in which he resides. He may think that he cannot bear the loss, but the loss in consequence of the slightest neglect will be much greater. The

fact, too, that there is a community of interests among fruit growers in this matter must not be lost sight of. Fruit growers must be mutually helpful in an emergency like this.

"(3) As precautionary measures to prevent the introduction of the scale into new districts, the following considerations are important: No orchardist should admit a single young fruit tree or a single cutting from a distance into his orchard without first carefully examining it and satisfying himself conclusively that it does not carry a single specimen of the San José scale; he should insist, also, on a guaranty from the nurseryman of such freedom. In addition, no fruit should be brought upon the premises without previous careful inspection. If this course is adopted by every one interested, without exception, the rate of spread of the species may be limited to the comparatively slight natural extension by crawling, by winds, and by the aid of other insects and birds."

S. A. FORBES, PH. D.;

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