

BULLETIN No. 124.

MAY, 1903.

ALABAMA.

Agricultural Experiment Station

OF THE

Agricultural and Mechanical College,

AUBURN.

The Horticultural Law.

Notes on Some of the Insects and Fungous Diseases
Affecting Horticultural Crops.

R. S. MACKINTOSH.

MONTGOMERY, ALA.,
THE BROWN PRINTING CO., PRINTERS AND BINDERS.
1903.

COMMITTEE OF TRUSTEES ON EXPERIMENT STATION.

JONATHAN HARALSON.....Selma.

STATION COUNCIL

C. C. THACH..... President and Acting Director.
B. B. ROSS..... Chemist.
C. A. CARY..... Veterinarian.
J. F. DUGGAR..... Agriculturist.
E. M. WILCOX..... Biologist.
R. S. MACKINTOSH..... Horticulturist.
J. T. ANDERSON..... Associate Chemist.

ASSISTANTS.

*C. L. HARE..... First Assistant Chemist.
A. MCB. RANSON..... Acting First Assistant Chemist.
T. BRAGG..... Second Assistant Chemist.
J. C. PHELPS..... Third Assistant Chemist.
T. U. CULVER..... Superintendent of Farm.
J. M. JONES..... Assistant in Animal Industry.

*On leave of absence.

The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Alabama.

THE HORTICULTURAL LAW AND RULES ADOPTED BY THE BOARD OF HORTICULTURE.

INTRODUCTION.

For years the horticultural interests in Alabama have suffered very much from the injury done by various insect and fungous pests. Most of the seriously injurious pests are distributed upon nursery stock from infested sections. The nursery trade is a legitimate one, and one that should be encouraged when honestly conducted. Since the introduction of the notorious San José scale the people have awakened to the fact that it is necessary to protect the planter from stock from infested nurseries. The method commonly adopted is to consider nursery stock infested with pests, as dangerous to the public welfare, and order such stock destroyed. To do this all nurseries have to be examined one or more times each year, to see if there are no pests on the stock growing therein. If all the stock is healthy a certificate of health is given, stating that the stock is apparently free from all such pests. Even with all this precaution the planter should ever be on the lookout for insects and fungous pests which may have escaped the eye of the inspector, or which may have gotten upon the trees or plants after the time he made the examination.

The many wide-awake fruit growers of Alabama have for years been trying to get adequate laws to aid them in protecting the industry in this State. This past winter the newly-organized State Horticultural Society took the matter up, and with the aid of others interested in the work, succeeded in getting the Legislature to pass the following law :

No. 121. Code of 1903.

AN ACT

To Further Protect Horticulture, Fruit Growing, and Truck Gardening, and to Exclude Crop Pests of all Kinds in the State of Alabama.

SECTION 1.—*Be it Enacted by the Legislature of Alabama.* That from and after the passage of this act, the Commissioner of Agriculture and Industries of the State of Alabama, the President of the Alabama State Horticultural Society, and the Director of the Experiment Station of the Alabama Polytechnic Institute shall, ex-officio, constitute a board to be known as the State Board of Horticulture, of which the Commissioner of Agriculture and Industries shall be chairman, which board shall have full power to enact such rules and regulations governing the examination, certification, sale, transportation and introduction of trees, shrubs, cuttings, buds, vines, bulbs, and roots, that they may deem necessary to prevent the further introduction, increase and dissemination of insect pests and plant diseases.

SEC. 2.—That the Professor of Horticulture of the Alabama Polytechnic Institute shall act as State Horticulturist and as secretary of said Board of Horticulture under the provisions of this act, and it shall be the duty of the said board to promulgate rules and regulations in accordance with this act for the government of the said State Horticulturist in the duties devolving upon him in execution of the provisions of this act.

SEC. 3.—There is hereby annually appropriated the sum of (\$1,500) fifteen hundred dollars, to be disbursed under the direction of the Board of Trustees of the Alabama Polytechnic Institute for the purpose of defraying the expense in the execution of this act.

SEC. 4.—The State Horticulturist or a deputy duly

authorized by the Board of Horticulture, shall have power under the regulations of the Board of Horticulture to visit any section of the State where such pests are supposed to exist, and to determine whether any infested trees or plants are worthy of remedial treatment or shall be destroyed, and he shall immediately report his findings in writing, giving reasons therefor, to the owner of the infested plantation, his agents or tenant, and a copy of each report shall also be submitted to the said board. In case of objections to the findings of the State Horticulturist or his deputy, an appeal shall be made to the said Board, who shall have power to summon witnesses and hear testimony on oath, and whose decision shall be final. An appeal shall be taken within ten days and shall act as a stay of proceedings until it is heard and decided.

SEC. 5.—Upon the findings of the State Horticulturist or his deputy in any case of infested trees or plants, the treatment prescribed by him shall be executed at once (unless an appeal is taken), under his supervision, the cost of material and labor shall be borne by the owner; provided, however, that in case the trees or plants shall be condemned they shall be destroyed by the State Horticulturist, and the expense of such action shall be borne by the owner. No compensation shall be allowed for any plants that shall be destroyed.

SEC. 6.—In case any person or persons refuse to execute the direction of the State Horticulturist or of the said Board upon an appeal, a Justice of the Peace or Probate Judge of the county shall, upon complaint filed by the State Horticulturist or any freeholder, cite the person or persons to appear before him within ten days after notice being served, and that the said judge upon satisfactory evidence shall cause the prescribed treatment to be executed, and the expense thereof and cost of

court shall be collected from the owner or owners of infested plants.

SEC. 7.—It shall be unlawful to offer for sale, sell, give away or transport perennial plants, scions, buds, trees, shrubs, vines, or other plants, tubers, roots, cuttings, bulbs, known to be infested with dangerously injurious insects or plant diseases. Any person or persons violating this section shall, upon conviction, be fined not less than ten nor more than one hundred dollars for each separate offense.

SEC. 8.—The said Board of Horticulture, its agents, or employes, are hereby empowered with authority to enter upon any premises in discharge of the duties herein described. Any person or persons who shall obstruct or hinder them or their agents in the discharge of these duties shall be deemed guilty of a misdemeanor, and, upon conviction therefor, shall be fined not less than ten nor more than one hundred dollars.

SEC. 9.—The Board shall have the power also to adopt rules and regulations, not inconsistent with the laws and constitution of this State and the United States, for preventing the introduction of dangerously injurious crop pests of all kinds from without the State or regarding the dissemination of crop pests within the State, and for the governing of common carriers in transporting plants liable to harbor such pests, to and from and within the State, and such regulations shall have the force of laws.

SEC. 10.—Be it further enacted, that the members of said Board, any two of whom shall constitute a quorum, in the absence of the third, shall, within thirty days of the passage of this act, and from time to time, draw up and promulgate through the press of the State the rules and regulations necessary to carry into full and complete effect the provisions of this act, carefully defining

what diseases or maladies, both insect and fungus, shall constitute infection in trees or plants, within the meaning and purview thereof.

SEC. 11.—It shall be unlawful for any person, firm or corporation to sell, give away, or ship within the State of Alabama any trees or shrubs or any other plants commonly known as nursery stock, without having a certificate of guarantee of the State Horticulturist of Alabama. A copy of such certificate of guarantee must accompany each box or package sold, given away or shipped. Such certificate must be dated within twelve months. If upon examination such stock is found to conform to the requirements of the said Board of Horticulture, the State Horticulturist must furnish a certificate to that effect. Any person or persons selling, giving away or shipping nursery stock without the certificate of the State Horticulturist shall be fined not less than fifty nor more than one hundred dollars.

SEC. 12.—Each and every person, firm or corporation residing and doing business outside of the State of Alabama, dealing in or handling trees, shrubs or other plants commonly known as nursery stock, shall file a copy of his or its certificate of his or its inspection furnished by the State Horticulturist, nursery inspector or other duly authorized official of his or its State or county with the Secretary of the Board of Horticulture. Upon the filing of this certificate as above prescribed, and upon request of the person, firm or corporation, a certificate will be issued to the same, and official tags bearing copy of such certificate and seal of the Board will be furnished the same at cost, provided, however, that the aforesaid certificate of inspection shall be adjudged satisfactory by the Board. Each box, bundle or package of nursery stock shipped into Alabama by any person, firm or corporation shall bear one of these tags, and shipments of stock not

thus tagged shall be liable to confiscation by the Board of Horticulture through its agents or employes.

SEC. 13.—No transportation company or common carrier shall deliver any box, bundle or package of trees, shrubs or plants commonly known as nursery stock to any consignee residing within the State of Alabama when said box, bundle or package does not bear the official tag or certificate of guarantee issued by the State Horticulturist without previously notifying the State Horticulturist of the particulars of the shipment as they may be required by the Board, nor without duly warning the consignee of his risk in accepting said shipment. Failure on the part of any transportation company or common carrier to conform to these requirements shall be deemed a misdemeanor, and shall be punishable in each instance by a fine of not less than ten nor more than fifty dollars. Provided, that no common carrier shall be liable for damages to the consignee or consignor for refusing to receive, transport, or deliver such trees, packages, or boxes, when not accompanied by the tag or certificate herein provided.

SEC. 14.—Any person, firm or corporation receiving from any other firm, or corporation, any box, bundle or package of trees, shrubs, or plants commonly known as nursery stock, which is not accompanied by a certificate of guarantee, or official tag issued by the State Horticulturist to cover said stock, shall be deemed guilty of a misdemeanor, and, upon conviction, shall be fined not less than ten nor more than one hundred dollars.

SEC. 15.—It shall be the duty of the State Horticulturist to make a quarterly report of his work, and of the expenditures under this act to the Board of Horticulture, and said Board shall report annually to the Governor of the State.

Approved March 5, 1903.

Official:

J. THOS. HEFLIN,
Secretary of State.

THE BOARD OF HORTICULTURE.

As provided by the above law the following persons are ex-officio members of the Board of Horticulture:

The Commissioner of Agriculture and Industries, Chairman.

The Hon. R. R. Poole, Montgomery.

The President of the Alabama State Horticultural Society,

Mr. W. F. Heikes, Huntsville.

The Director of the Experiment Station, Alabama Polytechnic Institute,

Prof. Chas. C. Thach, Auburn.

The Professor of Horticulture of the Alabama Polytechnic Institute, to be State Horticulturist and Secretary to the Board.

Prof. R. S. Mackintosh, Auburn.

The Board of Horticulture met at Auburn, March 20, 1903, and in accordance with Section 10 of the above act, the following insects and fungus diseases were considered dangerous and to constitute infestation in trees and plants:

(1) San Jose Scale, (*Aspidiotus perniciosus*.)

(2) The New Peach Scale, (*Diaspis amygdali*.)

When found in a nursery all infested stock to be burned. If San José Scale is found in the immediate neighborhood, all stock must be fumigated or certificate will be withheld.

(3) Black Knot, (*Plowrightia morbosa*.)

(4) Crown Gall, (*Dendrophagus globosus*.)

When found in a nursery all diseased stock to be destroyed, otherwise stock may be shipped.

(5) Peach Yellows.

(6) Peach and Plum Rosette.

All infested trees and nursery stock to be destroyed.

(7) Woolly Aphis, (*Schizoneura lanigera*.)

All badly diseased stock to be destroyed. Other stock to be fumigated or treated with kerosene emulsion.

RULES.

The following rules and regulations were adopted :

Rule 1.—The State Horticulturist is hereby charged with the enforcement of this act, and is directed to locate by personal visits, by correspondence or in such other manner as he may deem best, to locate the above named pests, so far as they exist in this State, and to take such action, in accordance with the above act, as he may deem necessary to control or eradicate the same.

Rule 2.—The State Horticulturist shall have power to require all nursery stock sold within the State of Alabama to be treated with hydrocyanic acid gas, when in his judgment the presence of any pest requires it, for the better protection of the interests of the citizens of the State. Upon the failure of any individual, firm or corporation to comply with this, the State Horticulturist is hereby authorized to withhold his certificate.

Rule 3.—All certificates of examination shall expire prior to July 15th of the year after date of issue.

Rule 4.—All nurseries are to be examined between July 15th and November 15th of each year.

Rule 5.—Definition of Nursery Stock.—In addition to fruit trees, the following if offered for sale are classed as nursery stock, and are subject to the regulations governing the examination and transportation of the same: Strawberry plants, vines, ornamental trees and shrubs. (Including field grown roses.)

Rule 6.—All appeals from the decisions of the State Horticulturist should be addressed to the Chairman of the Board of Horticulture, at the Capitol, Montgomery, Ala.

Rule 7.—All communications relative to the examination of orchards and nurseries should be addressed to the State Horticulturist, Auburn, Ala.

Rule 8.—A deputy duly authorized by the Board of Horticulture shall have the same power and authority as the State Horticulturist in carrying out the provisions of this act under the direction of the State Horticulturist.

It is not the intention of the Board nor the State Horticulturist to cut down and destroy orchards unless the case absolutely demands it, but rather to use some remedial treatment if possible. It will be the aim to see that the nursery stock sold in this State is free, or supposed to be free, from all seriously injurious pests. To make this law most effective everyone interested should help carry out the provisions of the law and to report promptly all cases of the violation of the law by any one.

The purchasers of nursery stock are requested to read Section 14, of the law, which makes it a misdemeanor for them to receive any nursery stock not provided with a certificate or official tag authorized by the State Horticulturist to cover such stock.

NOTES ON SOME OF THE INSECTS AND FUNGOUS
DISEASES AFFECTING HORTICULTURAL
CROPS.

Only the insects and fungous diseases enumerated by the Board of Horticulture, as very dangerous pests, are here described, and while they do not represent all those that injure our horticultural crops, yet, they do represent the more dangerous ones.

The good old adage "an ounce of prevention is worth a pound of cure" must be our motto, for, in fact, it is the foundation on which our Horticultural Law is built, *i. e.*, to examine all nursery stock so as to keep out the various insects and fungous pests.

Unfortunately the San Jose scale is found in many parts of Alabama. It was brought here on nursery stock from infested localities, and there is no hope of entirely ridding our state of this scale, but with the earnest efforts of the various growers, we should be able to keep it from spreading farther.

The State Horticulturist is ready to do all he can, to help in preventing the spread of the various pests on nursery stock, and to aid the owners of infested orchards to rid their premises of them.

Recommendations.—The best, as well as the most practical way of treating nursery stock, is to fumigate it with hydrocyanic acid gas. This is usually done by the nurseryman before the stock is packed for shipment. It should not be considered as an entirely safe remedy, but, rather, as one of the safeguards to use in securing clean stock. All growers should be continually on the watch for the first indication of any trouble foreign to the natural growth or habit of plant or tree.

After the trees have been pruned and ready to be planted, they may be dipped in the lime, sulphur and salt solution for a moment. This covers the trunk and branches with this insecticide, and should destroy most of the living scales.

Caution—In doing this only dip the top, do not submerge the roots, and do not treat at all when the buds have started. Fumigation or dipping can only be done when the trees are dormant—never after growth has started.

With one or both of these precautions, and then only getting the stock from regularly inspected nurseries, should practically guarantee trees free of any of the above named pests.

Orchard treatment.—When the scale is discovered in an orchard, all badly infested trees should be dug up and burned. These trees will be killed in a comparatively short time, from the injury caused by the scale, and besides, the owner is free from this source of infection. In the end it is a saving rather than a loss.

Undoubtedly the best remedy that we now have is the lime, sulphur and salt wash. This has been tried in a great many places, and has been found very successful in controlling scale insects. While it cannot be expected to kill all the scales at once, yet it kills the larger part of them, and helps to successfully keep them under control. To be effective the lime, sulphur and salt wash must be carefully made, and in spraying every part of the tree, from the ground up, must be covered. It is advisable to go over the trees a second time in order to cover parts overlooked the first time.

Spraying at best is laborious and disagreeable work, and unless done thoroughly and at the proper time, is little better than if not done at all. This wash can only be applied to the trees in winter time, as then the trees are dormant. It seems that the best time to apply it is just before the buds open in the spring.

So far no successful summer treatment has been found. As mentioned above, all badly infested trees should be destroyed and all others not so badly infested should be treated by covering the trunk and larger branches with the lime, sulphur and salt wash. Use one-half the regular strength, and apply by either a brush or spray pump. Be careful not to get too much on the foliage, although it is better to sacrifice some of the foliage rather than not to touch the larger part of the scales.

Spraying Outfits.—Too much can not be said in favor of having strong and effective spraying outfits. A small leaky pump, with only a few feet of hose, and a wornout nozzle are not the proper things to use in spraying trees. It is much better for several congenial growers to unite in purchasing a good, serviceable outfit, rather than for each to purchase smaller and less efficient apparatus.

THE SAN JOSE SCALE, (*Aspidiotus perniciosus*)
Comstock.

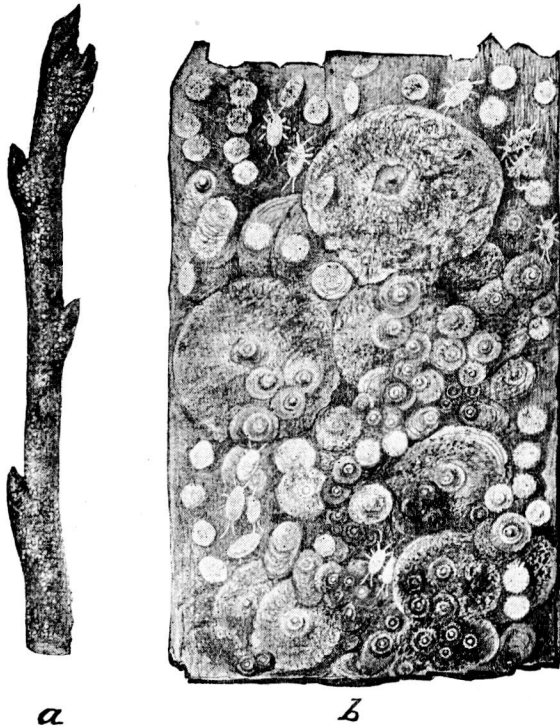


Fig. 1.—Appearance of scale on bark: *a*, infested twig, natural size; *b*, bark as it appears under hand lense, showing scales in various stages of development, and young larvae. (Howard and Marlatt, Bul. No. 3, New Series, Div. of Entomology, U. S. Dept. of Agr.)

How to detect it.—This scale is very small and it is rather difficult for an inexperienced eye to detect it. Roughly speaking, it is about the size of a pinhead. Seen

The description of the San Jose scale; New Peach scale; Black Knot; Peach Yellows and the Peach and Plum Rosette are by Prof. W. M. Scott, State Entomologist of Georgia; and those of the Woolly Aphis and Crown Gall are by Prof. S. A. Forbes, State Entomologist of Illinois.

under a hand lense the female is dark gray in color, circular and conical in outline, and terminates at the center by a nipple like prominence, surrounded by a distinct ring. The male scales are elongated and smaller, with the nipple near the anterior end. The real insect beneath the scaly covering is plump, circular in outline and yellowish. If crushed with the point of a knife the result is a pale yellowish liquid. The newly-born young are very minute mite-like creatures, long oval in shape, with pale orange color. They are quite active in seeking a suitable spot on which to settle, and in a few hours they have anchored themselves with their beak for life; except in the case of the males, which issue at maturity with wings, and become active again.

When a tree becomes crusted over with these scales the bark has the grayish appearance of having been coated over with dampened ashes.

Food Plants.—The San Jose scale may be looked for upon the following plants: Peach, plum, apple, pear, apricot, cherry, quince, almonds, rose, Hawthorn, raspberry, spiraea, cotoneaster, prunus pissardii, strawberry, flowering quince, mountain ash, gooseberry, currant, flowering currant, grape, English walnut, pecan, black walnut, persimmon, elm, osage orange, linden, euonymus, weeping willow, Kilmornock willow, English willow, golden willow, cotton-wood, Lombardy poplar, Carolina poplar, catalpa, sumach, silver maple, and perhaps some others.

Treatment.—For nursery stock, fumigation with hydrocyanic acid gas in an air-tight room is the only safe remedy; and, in fact, this treatment cannot be considered an absolute surety against the scale, since some unknown opening in the house may allow the gas to escape before it has done its deadly work. Where trees are actually known to be infested they should never be used, but should be burned. There is too great a risk in the use of infested stock, no matter to what treatment it may have been subjected. Fumigation is a good precaution, and every nurseryman should fumigate his stock, not only on account of the probable existence of scale in his nursery, but also on account of other insects that are usually present on nursery trees to a greater or less extent. This work of fumigation is accomplished

by packing the trees in a *air-tight* room and subjecting them to the fumes of hydrocyanic acid for thirty-five minutes. The gas is generated by treating chemically pure potassium cyanide with the best grade of commercial sulphuric acid at the rate of $1\frac{1}{4}$ oz. of cyanide, $1\frac{3}{4}$ oz. of acid and 5 oz. of water to every 150 feet of cubic space in the room.

PRELIMINARY TREATMENT.

Unfortunately there seems to be no satisfactory summer treatment for the San Jose scale, and winter applications must be chiefly depended upon for the control of this pest. However, it is not infrequent that summer spraying can be done to advantage. This insect multiplies at a rapidly increasing ratio during the breeding season until checked by cold weather about the middle of November or later. In this climate, therefore, the period of greatest reproduction among the scale insects, and consequently of greatest damage to the infested trees, is from about the middle of September to the middle of November. Trees that are only slightly infested in July may become encrusted with scales by November. Frequently this rapid fall multiplication of the scale, if left unchecked, results in the death of a great many trees before a winter wash can be applied.

The value of late summer or fall spraying in checking the progress of the scale has been determined not only by our experiments, but also by practical work in large orchards. A 10 per cent. strength (or even 15 per cent. when carefully used) of kerosene or crude oil applied in mechanical mixture with water, or in soap emulsion, does not materially damage peach trees in foliage and does destroy large numbers of scale insects, especially the recently issued young and a considerable per cent. of the breeding females. During the breeding season the progress of the scale should be watched, and if it threatens to kill or impair the infested trees before winter sets in, two or three applications of oil should be made. These may be made at intervals of two or three weeks, as occasion seems to demand, but even two applications on successive days or with one day intervening, are considerably more effective than a single one. The trunks and larger limbs should be thoroughly sprayed, but

drenching of the foliage should be avoided as much as possible. The oil has a tendency to scorch the foliage, but not to a serious extent if the work is properly done.

HOW TO PREPARE THE SPRAYING MATERIALS.

KEROSENE OIL EMULSION.

Formula and Directions.—An emulsion of either crude petroleum or kerosene may be made from the following formula :

2 pounds potash whale-oil soap.
4 gallons water.
8 gallons oil.

Weigh the soap carefully and place with the water in a vessel over the fire, using a slight excess of water to make up for evaporation. Fit a pump with a short piece of hose, to which is attached a nozzle for throwing a straight stream 3-16 or 1-4 inch in diameter. Pour the oil into the barrel or tub in which the pump is set, and when the whale-oil soap is dissolved, and the solution begins to boil, add it to the oil, and pump the whole vigorously back into itself for a period of at least ten minutes. The stream from the nozzle should be directed straight downward into the mixture so as to stir it to the very bottom. After a few minutes the oil and soap solution will be seen to combine, forming a thick, creamy emulsion, which when perfectly made will remain without change for weeks.

For a 20 per cent. strength add water to make 40 gallons.

For a 15 per cent. strength add water to make 53 1-3 gallons.

For a 10 per cent. strength add water to make 80 gallons.

Materials and Pump Required.—Either crude oil or kerosene will give good results in making emulsion. The soap should preferably be some soft whale-oil soap, such as Good's No. 3. If a hard soap is used the emulsion will be curdy, and only with difficulty mix with water.

The ordinary Bordeaux spray pump answers very well for mixing the emulsion, but almost any pump will do nozzle A "Bordeaux" or "Seneca" nozzle gives a very that can be fitted with the requisite section of hose and

satisfactory sized stream for this work, though rather small.

The water used must be soft, for if hard no stable emulsion can be prepared, and it sometimes happens that foreign substances chancing to be present, will prevent the emulsification. In case limestone or hard water is to be employed, it should be broken by the addition of a small quantity of lye. If a lot of soap solution and oil, for any reason, fails to emulsify properly, the best thing to do is to throw the whole away, carefully clean up the pump, wash out all the vessels used and begin over.

Properties of the Emulsion.—The emulsion, if well made of the proper soap, will retain its creamy consistency when cold, and is easily mixed with water in all proportions. No alarm should be felt if a small portion of the soap and water fails to emulsify, and separates at the bottom, nor, if after being exposed to the air for some time, a thin scum forms over the surface. If on long standing globules of free oil rise to the surface, or if a thin ring of oil collects around the sides of the containing vessel, the emulsion should either be thrown away, or warmed up and agitated afresh.

When diluted the emulsion may slowly rise, like cream, to the surface, and in order to prevent this the spray pump in which it is to be used should be provided with an agitator.

Never try to boil the kerosene over the fire; it is not necessary, and besides it is very dangerous.

THE LIME, SULPHUR AND SALT WASH.

FORMULA AND DIRECTIONS.

This wash may be prepared by combining lime, sulphur and salt in several different proportions, but the following appears to be the generally accepted formula:

Quick lime	30 pounds.
Salt	15 pounds.
Flower of sulphur	20 pounds.
Water to make 60 gallons.	

Slake half the lime carefully and place it in a large kettle with 25 gallons of water; grind the sulphur up with a little water, breaking the lumps as fine as possible by passing through a seive and add to the lime; boil.

As it boils the liquid will gradually become thinner and thinner, the lime and sulphur dissolving simultaneously to form a deep orange-red solution. When the sulphur has apparently all entered into solution, which may take two hours or more, slake the remainder of the lime, add to it the salt, and pour the two into the lime and sulphur solution. Boil the whole for from half an hour to an hour longer, strain, and dilute with warm water to 60 gallons. Do not let it become thoroughly cold, but spray while yet warm.

The principal care in making up this wash is to make sure that the sulphur is thoroughly dissolved. Flowers of sulphur is apt to be more or less lumpy, and these lumps are very difficult of solution. The more thoroughly the sulphur is ground up with water before being boiled with the lime, the less time it will take in the boiling.

An iron kettle must be used if the boiling is done directly over a fire. A better and cheaper way, whenever a head of steam is available, is to place the sulphur, lime and salt together in a barrel half full of water, conduct the steam through a pipe to the bottom of the barrel and boil it for two or three hours, with occasional stirring, to make sure that nothing is settling. If a boiler is convenient, a pipe must be so arranged as to conduct steam to a number of barrels at once.

NEW PEACH SCALE. (*Diaspis amygdali* Tryon.)

How to detect it.—This scale is readily distinguished from the San José scale in that the female is a little larger, of a lighter gray color, with the elongated excuvial point ridged and located at one side of the center, and the male is smaller, elongated, with parallel sides and white. The excuvial point is similar to that of the female, but located at the anterior end. A tree badly infested has a white-washed appearance from the color of the male scales. Where only females occur, however, a grayish brown appearance is produced.

It is the habit of these insects to cluster about the trunk and the lower parts of the larger limbs of a tree.

The original home of this insect is probably either the West Indies or Japan. From its probable West In-

dian origin it gets one of its popular names, "West India" scale.

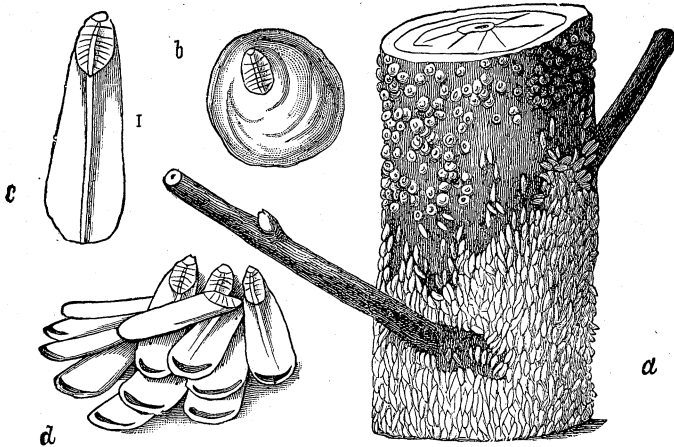


Fig. 2.—The New Peach Scale: *a*, branch covered with male and female scales, natural size; *b*, female scale; *c*, male scale; *d*, group of male scales—enlarged. (Howard, U. S. Dept. of Agr., Yearbook, 1894.)

It attacks the peach, plum, apricot, cherry, pear, grape, persimmon, and a few other plants.

Treatment.—The winter treatment for this insect is about the same as that for the San José scale. The female pass the winter in the mature and partially mature state, and can be killed by the lime, sulphur and salt wash, or by the whale-oil soap treatment at the rate of one pound dissolved in one gallon of water. In Georgia there are three or four broods from eggs, which appear at more or less regular intervals, the first appearing about the middle of March, if the season is favorable. These broods should be watched for and ten per cent. kerosene or whale-oil soap at the rate of one pound to four gallons of water should be applied at the time of their appearance.

It is becoming one of the most dangerous pests with

which we have to contend, perhaps equal to the San José scale. Th most vigorous measures should be adopted for its eradication while it is yet in its incipency.

BLACK KNOT. (*Plowrightia morbosa* Sch.)

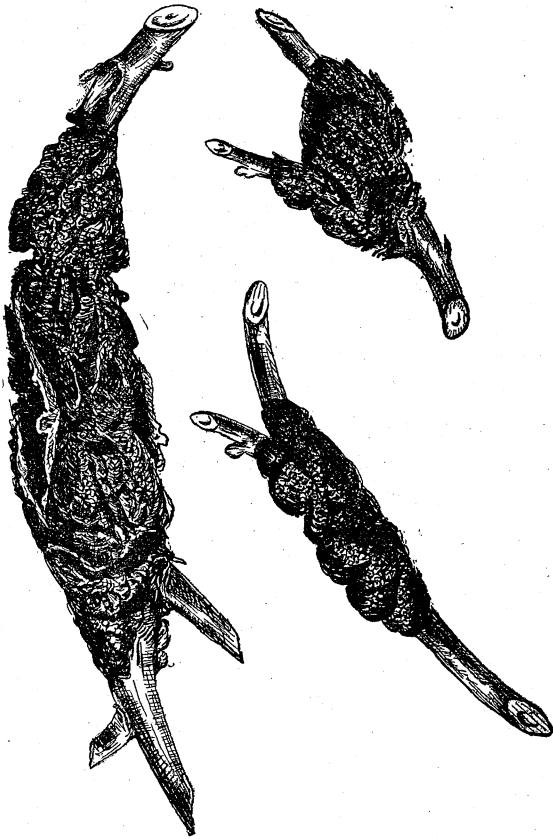


Fig. 3.—Black Knot.—Old knots on cherry twigs, natural size. (Scott, Bul. No. 1, Georgia State Board of Entomology.)

Plums and cherries are subject to the attacks of a disease very expressively termed "Black Knot." This dis-

ease is American in its origin and occurs more or less abundantly throughout the United States, but is especially prevalent in the Eastern States, where it seems to have first appeared. In some sections of the East growers of plums and cherries have been forced from time to time to abandon the industry in consequence of the ruinous effects of its work. Cases are on record showing that orchards that paid handsomely one year were completely destroyed the following year or two.

The more intelligent growers are fully aware of the injuries they are liable to suffer from its attacks, and whenever it appears on their premises they lose no time in removing it by cutting off affected parts or rooting up the diseased trees. Through such wise measures the disease has not been allowed to get beyond control.

How to detect it.—Some fully formed knots are illustrated in figure 3. These are large, rough, black excrescences, due to the growth of a fungus (*Plowrightia morbosa*) in the cambium layer of the branches or twigs. These crusty enlargements may extend entirely around the branch or grow lengthwise on one side. The first swelling usually begins in the spring, when the sap begins to flow; it may, however, occasionally be noticed in the fall. The first indication is a slight enlargement, usually longitudinal, which rapidly increases in size as the season advances. The bark is soon ruptured and finally scaled off, exposing a yellowish brown crusty surface. In May the fungus bears a crop of infecting spores on the surface of the knot, which gives it a velvety appearance. These spores are soon scattered by the wind or other natural agencies furnishing infection for other trees and thus disseminating the disease. The knot then becomes hard and black as fall is approached.

It has not yet completed its work. During mid-winter another crop of spores is produced and scattered. These gain lodgment in the cracks and crevices of the bark and in the forks of twigs and at the growing points, ready to germinate and penetrate the tissues of the bark as spring opens up.

Treatment.—The most effective method of controlling this disease is to cut out all the knots as soon as they appear and burn them. This work should be supplemented by spraying with Bordeaux (four pounds of copper sulphate and five pounds of fresh lime to fifty gallons of water). Four applications are necessary, two for the winter crop of spores and two for the summer crop. The first should be made about two weeks before the buds begin to open, and the second immediately before they open. The third application should be made about the middle of May at the time the summer crop of spores is produced, followed in about two weeks with the fourth.

All wild cherry and plum trees should be carefully watched, as they are frequently badly attacked, and affected parts must be cut away and burned.

THE CROWN GALL. (*Dendrophagus globosus.*)

This is a dark, rough, abruptly protruding tumor growing most commonly from the crown of the tree, and varying in size from that of a pea to that of the fist, or larger—the latter usually on old and long infested trees. A badly affected tree is likely to show signs of starvation, its growth ceasing and its foliage having a sickly yellow look. Young trees often perish from this disease, which is certainly contagious in some forms and perhaps in all, and even large orchard trees may die and finally break off at the base of the trunk.

Although much the most common above the crown, just below the surface of the ground, this gall frequently grows on the larger roots, and is sometimes seen exposed on the trunk. Appearing at first as a simple lump or tubercle, it may so extend its growth as to girdle the trunk with its large wart-like excrescences. Young galls while still fresh have at first the color of the roots from which they grow, but later darken from the accumulation of dead bark on their surfaces. They are at first, while very small, softer than the healthy tissue of the root, but harden with age, and their inner structure be-

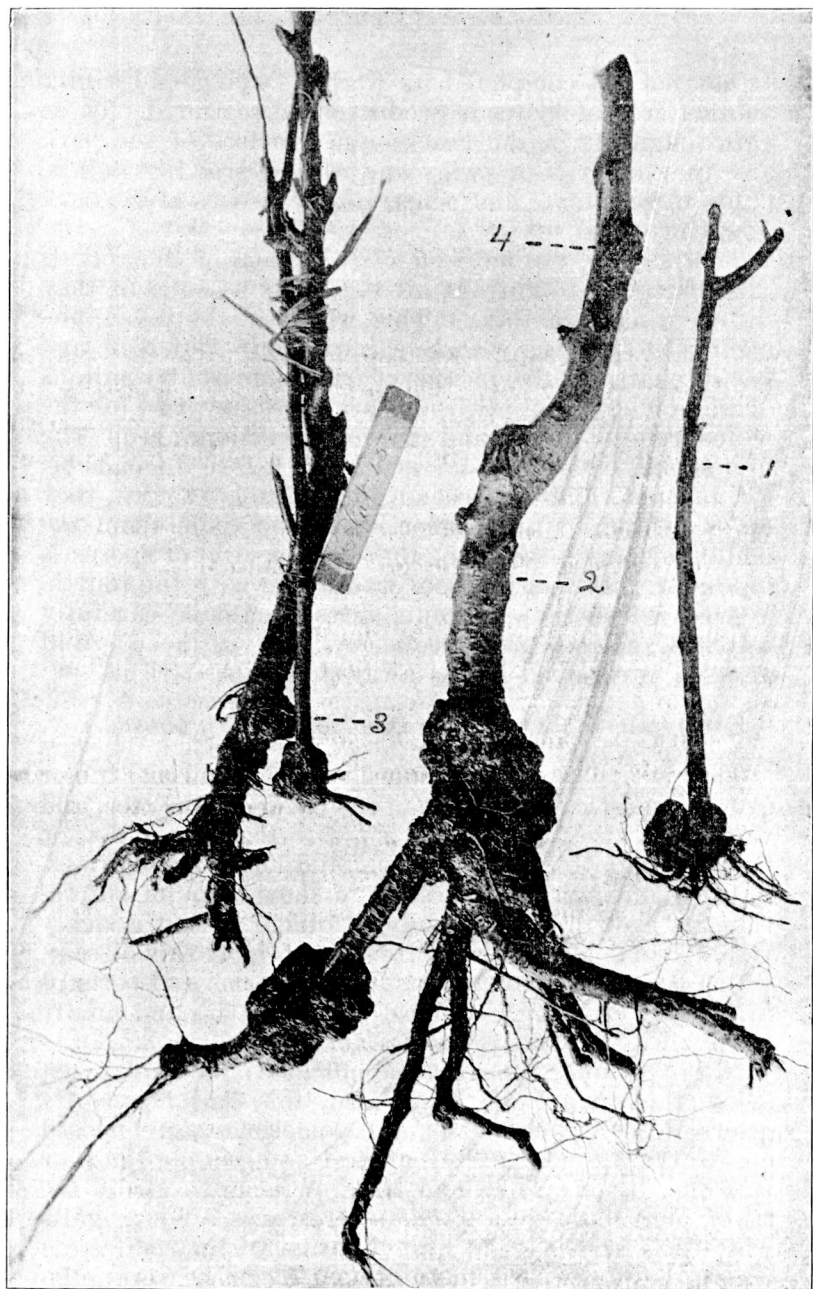


Fig. 4.—Crown Gall. 1, gall on Mariana Plum cutting; 2, gall at crown and on root of Elberta Peach; 3, gall on Peach induced by planting diseased Mariana Plum in juxtaposition; 4, gall induced by inoculation. (Quintance, Report Georgia State Historical Society, 1900.)

comes irregular and confused. On old galls, soft, white, growing points appear here and there in early spring, which enlarging rapidly, become gradually darker and harder, and by fall take on the appearance of the older growth.

There is much evidence that the crown-gall of the peach, apricot and almond is a contagious disease due to a minute parasitic organism (*Dendrophagus globosus* Toumey) belonging to a peculiar group of fungi known as the "slime moulds," but this conclusion has not yet been fully verified for the apple, the pear, the raspberry, or, indeed, for any other of the numerous kinds of fruit and ornamental trees and shrubs on which similar wart-like growths have been observed.

Until experimental work now in progress has been carried so far as to warrant conclusions on this point, the crown-gall of the apple, now extremely common in many nurseries of the Mississippi valley, can be regarded as a suspicious object, and not certainly as a dangerous one. But the careful nursemens, jealous of his business reputation, will not send out even suspected material, and in doubtful cases will give his customers the benefit of the doubt. On this account I strongly advise that no stock of any kind showing galls of this sort on crown, root or trunk should be placed on the market. All trees growing in close contact with those thus affected should have their roots dipped in Bordeaux mixture as a precautionary disinfectant, and the ground on which the stock so diseased has grown should be temporarily used for some other purpose than that of raising nursery stock.

PEACH YELLOWS.

It is American in its origin, and has been known for about one hundred years. It is quite generally distributed over the Eastern States north of Tennessee and North Carolina. Some of the most important peach sections of the East have suffered immensely from its destructive work and in not a few cases entire orchards have been completely destroyed. It seems to prefer peaches, but apricots, almonds, nectarines and Japanese plums are not free from its attacks.

How to detect it.—If the affected trees is in bearing, the first symptom is manifested in the premature ripening of the fruit, which may take place several weeks or

only a few days before the normal season of ripening. Premature ripening may be due to other causes, but the yellow peaches bear characteristic bright-red, measly blotches over the skin and streaks of red through the flesh often reaching to the pit. Another reliable symptom is the pushing out of newly formed buds at the ends of apparently healthy twigs or water sprouts, into short shoots with small yellowish leaves. Such buds should not normally put out until the following season. Also, the disease may cause dormant buds on the trunk and larger limbs to push into feeble, often branched shoots, characterized by narrow stiff leaves. This stage is illustrated in figure 5, showing the abnormal growth on a tree dying with the yellows. Affected trees may live for three to five years, during which time they are gradually weakened and finally the foliage becomes yellowish or reddish in color.



Fig. 5.—Yellows the fourth year. (Smith, Farmers' Bul. No. 17, U. S. Dept. Agr.)

The term "yellows" is somewhat misleading. Quite a number of supposed cases of yellows in this State have been reported to the writer, but, upon investigation, the

yellowing of the foliage in every case proved to be due to the peach borers, drouth or some other weakening effect on the trees. Premature ripening of the fruit from similar causes has also lead many to believe their trees to be affected with the yellows. The absence of red spots on the skin and red streaks through the flesh of the fruit should serve to relieve uneasiness in such cases.

The cause of yellows is yet undetermined, but it is definitely known that it is a disease and can be communicated from tree to tree and from orchard to orchard. Experiments have shown that it can be communicated to healthy trees through buds taken from diseased trees, but the manner of its natural spread from tree to tree is yet unknown. It is known, however, that from scattered cases in the orchard it will gradually spread over the entire orchard and completely destroy it if left unmolested.

Prevention.—Since yellows is an incurable disease, we can only look to preventive measures for protection.

(1) Peach trees should not be obtained from nurseries located immediately in infested sections. Such stock is liable to develop yellows after planting out.

(2) Peach pits from affected trees should never be planted. They may reasonably be expected to convey the disease to the young stock.

(3) Whenever the disease appears in an orchard every affected tree should be rooted up and burned. Simply cutting off affected parts is not sufficient. The virus exists in the apparently healthy parts and would soon develop the symptoms of yellows. The whole tree, root and branch, must be destroyed.

PEACH AND PLUM ROSETTE.

Similar to the yellows is a disease known as "Rosette" from the peculiar tufts into which the leaf buds grow on trees under the influence of the disease. It attacks peaches and plums and is quite generally distributed over the northern portion of Middle Georgia, extending from Augusta to the Alabama line, and from Macon to some distance north of Atlanta. The writer has quite thoroughly worked the State over and has never found it south of Macon nor in extreme North Georgia. It also occurs, although to a limited extent, in Eastern Kansas and in Western South Carolina. It seems to be most

prevalent in Georgia,, where it has been known for about twenty years. It causes the destruction of many trees annually in infested sections of this State, but the growers do not consider it with any great dread from the fact that they effectively hold it under control by the destruction of all affected trees as soon as the disease appears. In some localities, however, rosetted trees have been left in hedges and waste places to propagate the disease and cause considerable destruction to adjacent orchards.



Fig. 6.—Rosette induced in a seeding by inoculation. (Smith, Farmers' Bul. No. 17, U. S. Dept. Agr.)

How to detect it—Figure 6 well illustrates the appearance of a tree affected with rosette. This clustering together of the leaves into rosettes usually takes place in early spring and is one distinguishing character of the disease. The foliage assumes a yellowish green or orange color, or, in case of plums, particularly a beautiful red color. The leaves have a straight, stiff appearance with

inrolled margins. One season is usually sufficient to completely kill the affected tree. In some cases, however, a tree may live two years, especially if it is not attacked in all parts at once; but when a tree is once attacked it never recovers.

Prevention.—The same preventive measures suggested for yellows apply also to rosette, and particularly should all diseased trees be promptly dug up and burned. Fence rows and hedges where peaches and plums are growing should be watched and affected trees destroyed. By a series of experiments, Dr. Erwin F. Smith,* of the U. S. Department of Agriculture, determined that it can be communicated by bud inoculation, it being necessary, however, for the tissues of the bud and stock to unite before inoculation is effected. Further than this its manner of spread is unknown. Dr. Smith suggests that possibly the disease may enter through the roots, but this has not yet been proved. It is certain, however, that it does spread naturally and that a few affected trees left standing in an orchard will in time cause the destruction of the entire orchard. Hence the importance of rooting up diseased trees.

THE WOOLLY APHIS. (*Schizoneura lanigera*.)

This insect is especially injurious to young apple trees, first in the nursery and then in the orchard. It is most abundant and does its principal damage on the roots of the trees, but spreads also to the bark above ground, where it is particularly likely to appear on the young sprouts which start up from the root of an injured or unhealthy tree. Where abundant it forms bluish-white cottony patches, not unlike some kinds of mould, which, on careful examination, are seen to consist of a crowd or layer of minute sluggish insects, their bodies covered with a cottony coating which gives the general effect described. They are usually most abundant on the roots, but sometimes appear above ground also on the bark of

*Farmers' Bulletin, No. 17, U. S. Dept. Agr., page 17.

the trunk or branches. On the exposed parts of the tree they are most likely to be noticed about the collar and at the forks of the principal branches, or wherever an injury to the bark has left a scar. When trees in a nursery or young orchard have a sickly look—the leaves dull and yellowish—and are not growing well, the pres-

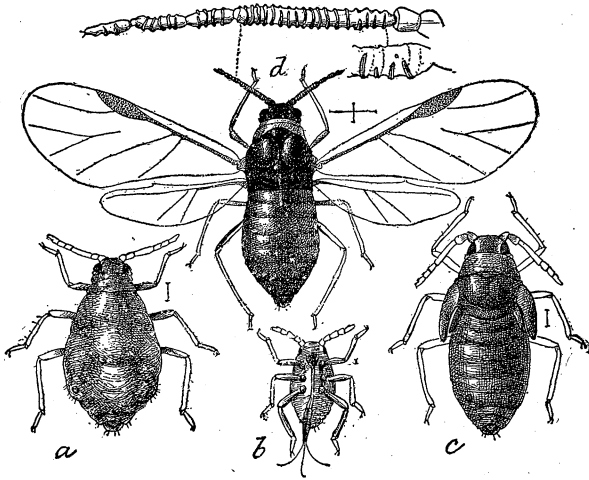


Fig. 7.—Woolly Aphis (*Schizoneura laniger*.)—*a*, Agamic female; *b*, larval house; *c*, pupa; *d*, winged female with antenna enlarged above, all greatly enlarged and with waxy excretin removed. (Marlatt, U. S. Dept. Agr.)

ence of this insect on their roots may be suspected even though there may be no appearance of it on the bark above ground. If the roots of such an infested tree be examined they will commonly be found distorted and deformed with hard knot-like enlargements, many of them almost dead, or even in course of decomposition. These gall-like growths occur on roots of all sizes to a depth of a foot or more beneath the surface. Unless the tree is so far gone that the insects have deserted it, they will commonly be found upon these injured roots at all seasons of the year.

The apple is the only tree liable to attack by this insect, the current supposition that it may live on the roots of forest trees being an error due to confusion of injury by the woolly aphis with that by the root-rot. As

it lives under ground at all seasons of the year it comes to infest more or less generally the soil itself, although this may be cleared of it by a few months' thorough cultivation sufficient to destroy effectively all living apple-roots. Like many other plant-lice, the woolly aphid multiplies throughout the greater part of the year by the birth of living young from generations of wingless fe-

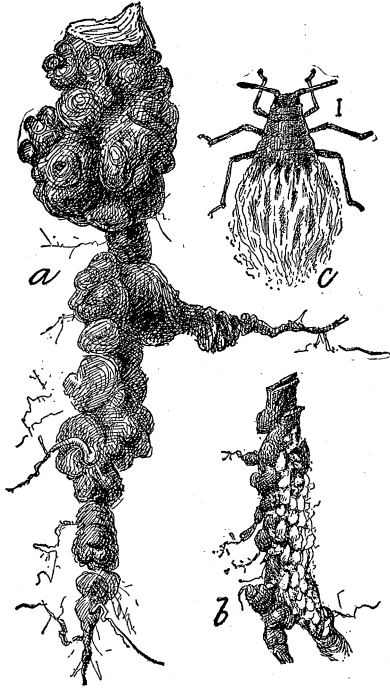


Fig. 8.—Woolly Aphid (*Schizoneura lanigera*).—*a*, root of young tree illustrating deformation; *b*, section of root with aphides clustered over it; *c*, root louse, female—*a* and *b*, natural size; *c*, much enlarged. (Marlatt, U. S. Dept. Agr.)

males only, but in October or November winged females appear somewhat abundantly, and, flying freely, especially before the wind, distribute the species widely. From these descend in the same autumn a generation of males and females, the latter of which eventually lay each a single winter egg. This is commonly placed within a crevice of the bark, and, hatching in spring, give rise to a new colony. There may be more or less migration back and forth from the groups above ground

to those on the roots at almost any time of the summer and fall.

This insect is universally distributed and extremely common, both in orchards and nurseries, becoming evidently more so to the southward. Being highly injurious to young trees, it is a difficult pest to deal with in the nursery trade. It probably cannot be wholly eradicated from an infested nursery, and, perhaps, can never be completely and permanently kept out of a new plantation. Fortunately, trees a few years old, once well established, commonly suffer but little from its presence, and our preventive and remedial measures must consequently be directed to the preservation of young stock. No tree whose roots are visibly injured by the woolly aphid should be allowed to go from the nursery, and none in the least infested by it should be sent out until the roots have been freed from it by insecticide application.

The simplest method of destruction of the aphid on the roots is dipping for a few seconds in water kept heated to 130-150 deg. Fahr. Where heat cannot be conveniently maintained, kerosene emulsion, diluted to contain about ten per cent. of kerosene, may be substituted. In the nursery, seedlings or graftings may be protected by using tobacco dust freely in the trenches in which they are planted, or by sprinkling together dust in a shallow furrow along each side of the nursery row as closely to the tree, and afterwards covering loosely with earth. Infested trees should not be sent out from the nursery except after fumigation with hydrocyanic acid gas or after dipping the roots in hot water or in kerosene emulsion. Trees with aphid galls or knots should never be sold, but thrown out and burned. Trees which have been growing longest in the nursery are usually the worst infested. Culls kept from year to year, apt to be mere nurseries for the multiplication of these and other destructive pests. In preserving overgrown trees in hope of making a cheap sale, the nurseryman usually "saves the penny and loses the pound."