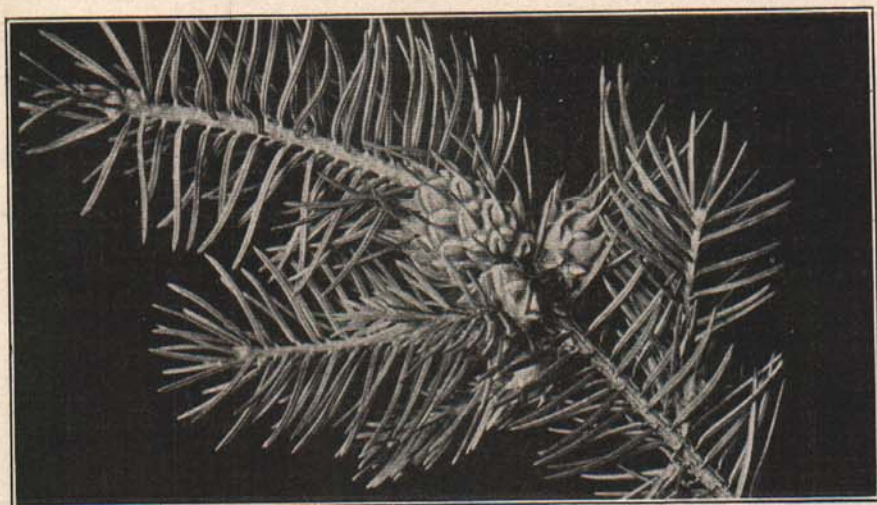


Some Common Sucking Insect Pests Of Evergreens



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FOREWORD

It is hoped that this bulletin, which is the first of a series dealing with pests of outdoor ornamentals, will prove useful both to the fancier of evergreens and to nurserymen.

The selection of the pests herein discussed has been based on numerous requests for information concerning the life-histories and control of the various insects which are troublesome in evergreen nurseries and among recently transplanted conifers.

Respectfully submitted,

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Entomologist of Experiment Station.

SOME COMMON SUCKING INSECT PESTS OF EVERGREENS

By E. I. McDANIEL

There are a number of sucking insects known to infest conifers. Of these, the following have been the most troublesome in Michigan for the past few years.

THE SPRUCE GALL APHID

(*Adelges abietis*)

The Spruce Gall Aphid causes cone-like galls to develop at the base of the new growth of various species of spruce. Not only Norway, but also red, black, blue, white, and Engelman's spruce as well, are at times infested. This aphid comes from Europe and today is distributed throughout the spruce belt of America. At present it is attracting a great deal of attention in the northeastern part of the United States, probably because so many spruces are being used in ornamental plantings.

The Spruce Gall Aphid spreads slowly and shows a decided preference for certain individual trees. Young trees seem to be preferred, but both nursery stock and recently transplanted trees suffer from its attacks. While it is probably capable of establishing itself on any variety of spruce, the Norway spruce is most frequently injured.

Life History—European entomologists fail to agree as to the details of development of this pest, one group maintaining that it spends part of the time on larch, protected by a white wooly covering; while the other group is convinced that no migration to any other host tree is required. Our own observations lead us to accept the latter view.

In the United States, there are two annual generations of the Spruce Gall Aphid. These insects pass the winter as tiny, naked, greenish-black nymphs in crevices about the bud scales. Early in the season, when the sap begins to move and before growth starts, this tiny overwintering form moves out on the twig, where it completes its growth and begins to lay eggs. At this season of the year, it is easily found, for, while at all times very small, the snow-white, cottony mass which envelops the aphid at this time, and which also serves to hold the eggs together, is fairly conspicuous. In five or six days these eggs hatch and the young settle down in colonies at the base of the new growth. Their attack causes the individual bases of the leaves to become enlarged, each one forming a bulb-like hollow. There may be as many as 50 cells in a group, each of which may contain as many as a dozen young aphids. The fully developed gall resembles a tiny pineapple,

varying in size all the way from half an inch to an inch or more in length. It is possible for the gall growth completely to check the growth of the twig, though this is unusual; for, as a rule, the healthy part of the twig protrudes several inches beyond the gall. In cases where but a few leaves are deformed, the twig may not be completely encircled.

The galls thus formed are pale green in color, with the closed mouths of each cell conspicuously marked by an inverted V-shaped line of brick red or vivid purple, depending on the age of the gall. The hollow, bulb-like bases of the leaves open in mid-August, and from them emerge young with well developed wingpads. These individuals wander about the terminal growth and develop into winged adults which deposit the eggs from which are to hatch the overwintering individuals. The

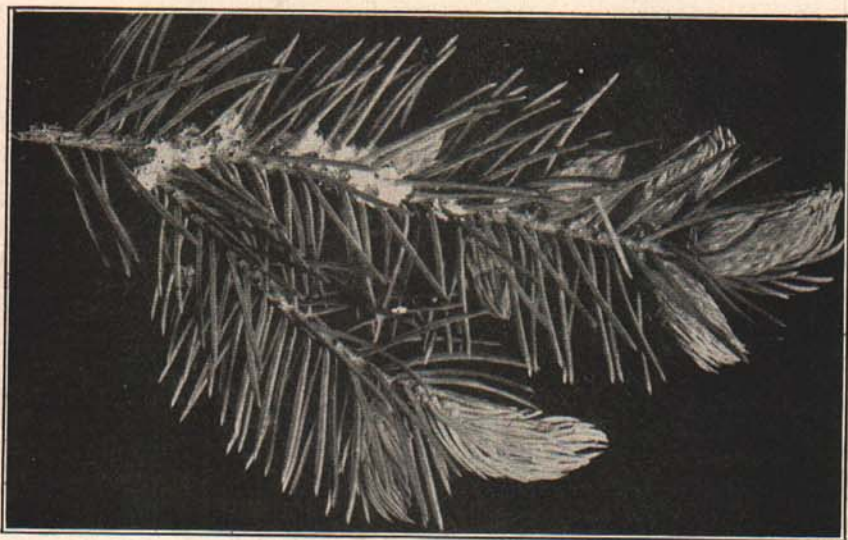


Fig. 1.—Empty egg-masses on old growth. New growth just starting.
(*Adelges abietis*.)

females, while winged, apparently do not migrate readily, since they seldom move from the location where molting has taken place. Later in the season their dead bodies, each placed protectingly over an empty mass of egg shells, may be found clinging to the needles. Each female deposits a batch of about 50 eggs, which hatch in five or six days, and the young seek winter quarters in crevices around the buds. Many individuals winter-kill, and heavy rains, before they are properly established for the winter, may wash them away.

Injury—The galls retard the normal growth of the twigs. After the aphids leave the galls, the latter turn brown and die. Frequently the twig is killed outright, leaving the dead galls adhering to the limbs for a long time. Their presence detracts from the beauty and vigor of the new growth; for, even where the twig is not killed, the growth is distorted.

Mature, vigorous trees are seldom permanently injured, though the new growth may be rendered scraggly and unsightly. However, there are instances on record where severe infestation has so lowered the vitality of the trees that other injurious insects have been attracted in sufficient numbers to kill the trees.

Small trees which have been recently transplanted, when severely infested, are often killed outright. In other cases, their vigor has been so impaired that the trees were rendered worthless.

Control—Spray in the spring just before growth starts with one of the miscible oils. (See page 13).



Fig. 2.—Young spruce galls. (*Adelges abietis*) and cottony covering of empty egg-masses.

(*Adelges similis*)

Adelges similis causes the formation of loose terminal galls on Norway, white, red, and black spruce. Wherever the galls are present in numbers, honey-dew is usually produced in quantities sufficient to render the tree unsightly.

Life History—The life history of this species has not been followed out in detail, but we know that two distinct forms leave the sheltering galls early in July.

One type possesses well developed wing-pads and molts almost immediately on leaving the gall. This form secretes a quantity of white flocculent material which affords excellent protection for both the adults and their eggs. These winged individuals freely migrate shortly after they acquire wings, redistributing themselves among the spruces within reach. The other type of individuals consists of small, mature, wingless, egg-laying aphids. They are fewer in number and may be found laying their tiny eggs in their conventional nests of white cottony material, both inside the galls and outside on the stems.

Injury—The formation of terminal galls kills the tips of the twigs,

causing numerous lateral growths which result in giving the tree a brushy appearance. The development of mature trees is retarded and recently transplanted trees or nursery stock may be killed outright. Early in the season, the galls take on a ragged appearance, making the trees look shaggy. At first the galls are pale green in color, though later in the season they die and turn brown, usually dropping off the following year.

Control—Dormant applications of an oil emulsion or a miscible oil early in the spring before growth starts. (See page 13).



Fig. 3.—Terminal galls of *Adelges similis*.

THE PINE BARK APHID

(*Adelges pinicorticis*)

Wherever white pines are to be found in the United States, there we may expect to find the cottony masses of the white pine bark-aphid on the trunks or limbs. Other pines are attacked as well, but the white pine is always first choice. The naked young of this pest are gregarious and settle in colonies, sometimes quite large ones, on the under sides of the limbs and along the main trunk where the bark is not too thick. Shortly after the colony becomes established and the young commence to feed, a white flocculent growth develops on their bodies, which gives the infested areas a "white-washed" appearance. This aphid seldom appears on trees in natural stands, but may become a problem in ornamental plantings, and at times it has caused the death of unthrifty trees. Worst of all, nursery stock may be stunted or killed outright by a severe attack.

Life History—The life history of this species has not as yet been completely worked out, but it is assumed that the females must winter over on the pine, since their eggs are to be found on the trees early

in the spring. From these eggs, soon hatch individuals which gather in conspicuous colonies on the bark of the trunk and on the under surfaces of the limbs. They are easily detected by reason of the snowy covering of cottony material. From such colonies develop winged individuals which fly from tree to tree, hastening the rapid spread of the pest, which is characteristic of the species.



Fig. 4.—Pine bark aphid on branches. (*Adelges pinicorticis*.)

The pine bark aphid usually deserts the limbs and branches of the pine in late spring or early summer, to appear once more in augmented numbers the following autumn. Its cottony coat, at first snow-white, later turns grey and adheres to the tree throughout the season.

Control—The pine bark aphid is most successfully controlled by a dormant spray applied just before growth starts in the spring. The lice are difficult to kill, since their cottony coverings are not easily wet through by sprays, and consequently the bodies of the lice are hard to reach. For this reason, sprays must be applied with a coarse nozzle and with high pressure.

Satisfactory results have been obtained in our experiments with any one of the following dormant sprays: Whale oil soap, one pound to



Fig. 5.—Pine bark aphid on limb. (*Adelges pinicorticis*.)

eight gallons of water; home-made oil emulsion, 2%; miscible oils, 1-30; or lime-sulphur 32° Baumé, one to eight.

For summer applications, or at any time when the tree is not in a dormant condition, the safest application is either one of plain water applied with enough force to wash the aphids off the tree, or an application of nicotine sulphate, used at the rate of one pint of nicotine sulphate to 100 gallons of water, plus four pounds of cheap laundry soap.

THE PINE LEAF-SCALE

(*Chionaspis pinifoliae*)

The pine-leaf scale is one of the shield scales. It attacks pine, spruce, and other conifers, throughout the United States and Canada.

The shields of both the males and the females are conspicuously white and are elongated, with the exuviae, or cast skins, terminal. The

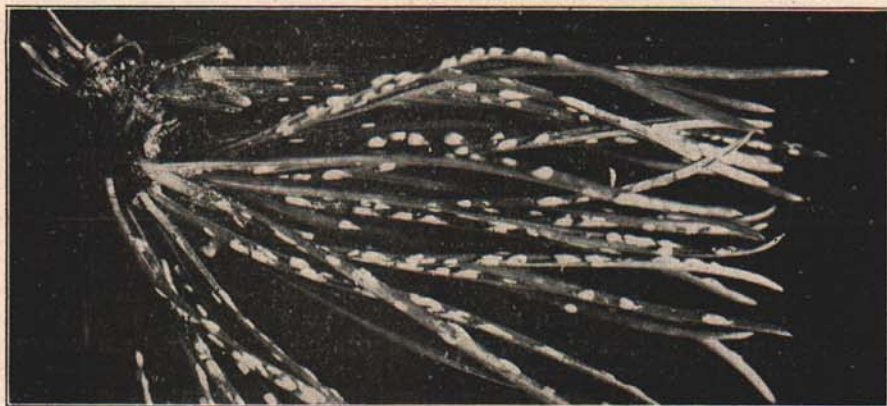


Fig. 6.—Pine leaf scale (*Chionaspis pinifoliae*).

shields of the males are smaller than those of the females and faintly ridged longitudinally. The shields of the females have a smooth surface. These pure white shields, standing out distinctly against the dark green of the needles, serve to make the infestation quite conspicuous.

This species passes the winter in the egg stage, the number of eggs under each scale varying from 20 to 30. There are at least two annual generations. The young hatch from the eggs in the early spring and wander about over the leaves for a few hours before they establish themselves. It is impossible to separate the two broods, because the eggs hatch over a prolonged period of time and scale insects in all stages of development may be found on the trees throughout the summer. Egg laying continues late into the fall.

Frequently we find stands of conifers which we have every reason to consider otherwise healthy, to be seriously infested with white pine

scales. Many times the infestation becomes severe enough to cause the trees to appear pale, stunted, and sickly, but of all such infestations observed, we have never known this scale to kill otherwise healthy trees or to do serious, permanent injury.

Fortunately there are many tiny parasites belonging to the Hymenoptera and several species of small lady bird beetles which attack this scale. It is due to the activities of these natural enemies that infestations are cleared up before the death of the tree takes place. The activity of these tiny Hymenopterous parasites may always be detected by the presence of tiny holes in the shields where parasites have emerged. It is not unusual, toward the end of a severe infestation, to find 30 or 40 scales on a single needle, each scale with a tiny puncture.

Control—The pine leaf scale has been easily controlled in our experiments by the use of any one of the miscible oils, applied before growth starts in the spring, following the strength recommended by the makers; or by a two per cent or three per cent application of a home-made boiled soap emulsion of a lubricating oil. (See page 13).



Fig. 7.—Spruce bud scale (*Physokermes piceae*).

THE SPRUCE BUD SCALE

(*Physokermes piceae*)

The Spruce Bud Scale passes the winter as an immature female. It infests several species of conifers, but is especially destructive to Norway Spruce.

The immature over-wintering females are small and inconspicuous. They collect in colonies of from three to six at the tips of the new growth, where, shortly after growth starts in the spring, they complete their development and eggs are produced in the gall-like bodies of the mothers. In Michigan, the eggs hatch about June first and the young establish themselves on the new growth for the next year's generation. The young are small and inconspicuous and so attract no attention until the following spring. The newly matured females are easily located,

their round gall-like bodies being ornamented with contrasting mottlings of brilliant brown and yellow, which is subdued by a delicate coating of powdery wax. In this stage of development, honey-dew is given off in quantity. It is not at all unusual to find the ground or sidewalk under infested trees smeared with this sticky substance. In fact, where the infestation is severe, bees, both hive-bees and wild ones, collect in large numbers and, in this way, attract attention to the infestation. All colonies which we have examined show holes bored in the bodies of the females, indicating the presence of parasites which undoubtedly do much to hold this species in check. Sickly trees, or trees in ornamental plantings, are most subject to attack, and while it is doubtful whether this insect will actually kill healthy trees, it certainly weakens them.

This scale can be controlled by a dormant application of one of the miscible oils or a two per cent home-made emulsion.

After growth starts, an application of nicotine sulphate, standard strength (one pint of 40 per cent nicotine sulphate to 100 gallons of water, plus four pounds of cheap laundry soap) applied shortly after the eggs have hatched, will kill many of the young. Such an application may be worth while on nursery stock or on some particularly prized ornamental. Whether oil or nicotine is used, the spray should be applied with considerable pressure. (See page 13).

THE SCOTCH PINE LECANIUM

(*Lecanium (Toumeyella) numismaticum*)

Lecanium numismaticum infests Scotch pine. It is known to occur in New York, Minnesota, Wisconsin, and Michigan.

There is, apparently, but one generation a year. The males appear in the fall and die after fertilizing the females. The empty, glistening, white pupal cases of the males remain attached to the twigs and young branches until the following season. These empty cases give the bark a scurfy appearance and serve to draw attention to the infestation.

The females pass the winter as partially grown individuals, wedged in among the empty pupal cases of the males. They cling tightly to the rough bark around bud scars or other places on the bark, and are difficult to detect, since their reddish-brown color so closely resembles the bark itself. The surface of the body has a wrinkled appearance, and is covered with a thin coat of transparent wax. The immature females, when they settle down for the winter, measure about an eighth of an inch in length, but as the season progresses they increase in size and turn dark brown in color.

The injury is not confined to feeding alone, being largely due to the abundance of honey-dew, which is produced in great quantities throughout the growing season. This honey-dew closes the breathing pores of the plant and checks the development of the tree. A sooty fungus growth establishes itself on the honey-dew, detracting from the appearance of the tree.

No opportunity for experimental work in the control of this scale

has presented itself, but it should respond to any of the oil sprays recommended for late dormant use on the plant-lice of evergreens.

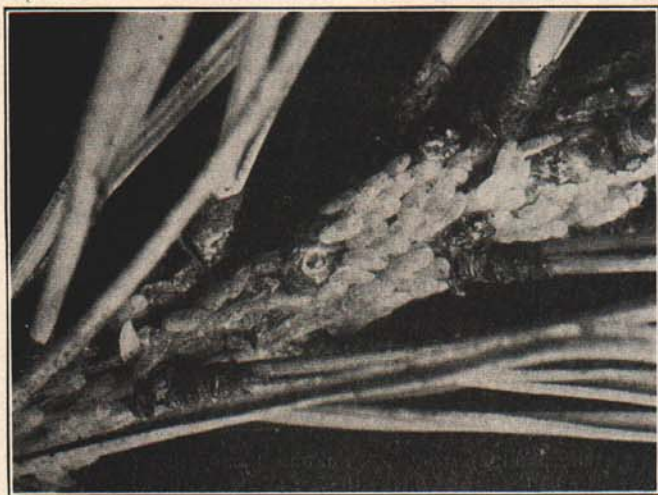


Fig. 8.—The Scotch Pine Lecanium, (*Toumeyella numismaticum*).

THE SPRUCE MITE

(*Paratetranychus ununguis*)

During the hottest part of the summer, our evergreens sometimes begin to turn dingy. The bright green of the foliage turns grey, and sometimes we are able to detect delicate threads of a web-like nature spun over the twigs. A closer examination may be rewarded by the finding of very minute crawling mites which, under the compound microscope, are found to have eight tiny legs. Such a condition of affairs usually indicates the presence of the spruce mite which infests a variety of conifers and is quite generally distributed throughout the North Temperate Zone of both continents.

The Spruce Mite passes the winter in the egg stage, the eggs being tucked in around bud scales and the bases of needles. The brown eggs of the spruce mite differ from those of the common red spider in that a central shaft or staff projects upward from the center, while the eggs of the common red spider are smooth on top.

The eggs hatch in the spring before growth starts. The young mites are pale green in color but usually grow darker with each successive molt until finally the adults vary from dark green to nearly black. The dorsal surface of the body is ornamented with plumose spines, and the legs of mature specimens are salmon pink in color. The characters which separate this species from other closely related forms are microscopic, the most important characters being located on the tarsal claws and other minute appendages located on the front foot of the adult female.

A quantity of silk is secreted, which affords excellent protection for both the eggs and the mites in all stages of their development.

Infested trees may be detected among healthy trees by the dullness of their foliage, which in general takes on a "rusty," unthrifty appearance. Closer examination will show the presence of the webbing so characteristic of mite work, and the pale, greyish foliage.

The old, mature needles show the effects of the mites first, and when an infestation occurs among mature trees, the complete defoliation of the tree may extend over several seasons, the lower branches dying first. Young nursery stock or small trees recently transplanted, when infested, are usually killed outright, the young tree often being killed in one season.

The spruce mite, in common with other mites, is always more abundant in hot, dry seasons. Several generations are produced annually, the number produced being governed by temperature and moisture conditions. Mites in all stages of development are present on the trees from early spring until fall, the generations overlapping to such an extent that it is impossible to separate one brood from another.

A period of from 15 to 20 days is the average length of time required to produce a generation during the summer, the time being prolonged during the spring and fall.

Control—A spray of a miscible oil applied just before growth starts and while the tree is still dormant, diluted according to the specifications of the maker, serves to eliminate or check the mites. When an infestation becomes serious during the growing season, the mites can be controlled by spraying with glue water,* using one and one-half pounds of glue to 10 gallons of water. The results will be improved if a spray pump which drives the spray in with considerable force is used. The glue should be soaked in water, dissolved with heat, and strained into the spray tank. When this precaution is used, no trouble with clogged nozzles results. An application of glue improves the appearance of the trees and leaves the needles shining as if they had been specially cleaned. Occasionally the tips or new growth have a tendency to stick together or to ball up. This can readily be remedied by an application of water.

We were able to secure commercial control with two applications of glue in a season. These applications were made about four weeks apart.

CONTROL MEASURES

The one measure which has given the best commercial control for the insects discussed in this paper, along with the minimum amount of injury to the trees, has been the application of an oil spray put on in the spring just before the growth of the trees starts.

Aphids, scale-insects, and mites are coming out of the dormant state in which they have passed the winter, and are fairly susceptible to contact sprays at this time. Also, the foliage of conifers is ENTIRELY made up of ripe needles, no new, tender, growth having as yet ap-

*A method developed by Professor A. G. Ruggles, State Entomologist of Minnesota.

peared, so that it will withstand more drastic treatment than at any other time. The sprays which have been thus successfully employed on dormant trees are, in the order of their efficiency: miscible oils and oil emulsions, lime-sulphur, and whale-oil soap.

Whatever spray is used should be applied just as the buds are ready to burst, and care should be taken to hit the tips of the twigs and the under sides of the branches. If the pressure be kept up to about 200 pounds, results will be correspondingly improved.

DORMANT APPLICATIONS

Oils—Oils are effective against aphids, scale-insects, and mites infesting conifers. Miscible oils diluted with water one to 30, or home-made oil emulsion used at two per cent strength, applied in the spring just before growth starts, have proved satisfactory in our experiments. There are a number of miscible oils on the market, each differing somewhat from the others. For this reason, the strength recommended by the makers should be used. The home-made oil emulsions used in our experiments were made up with a light grade of lubricating oil. In any case, one should be sure that the emulsion is perfect before making the application. This means that no oil separates out and floats on the surface. Where oils are used, one must be careful to time the application so that the temperature will not fall below freezing until the spray has thoroughly dried.

DORMANT APPLICATIONS

Oils—Oils are especially recommended where the spruce mite, (*Paratetranychus ununguis*), is present; for while certain other sprays will control the aphids, if properly timed and applied, they have not been so effective when used against the mite.

Lime-sulphur—Commercial lime-sulphur 32° Baumé, diluted one to eight, is sometimes applied to conifers just before growth starts in the spring. It gives good control for aphids, especially for the Pine Bark Aphid, but is objectionable because the stain remains on the trees for a long time.

Whale-oil-soap—Whale-oil-soap, using one pound in eight gallons of water, applied in the spring just before growth starts, has given an effective control for aphids in our experiments.

SUMMER APPLICATIONS

At times, serious infestations are discovered during the summer, and an immediate need of employing control measures arises. It is possible to obtain favorable results against aphids, during the summer, with contact insecticides. Under such conditions nicotine and soap are recommended.

Where the trouble is due to mites we recommend an application of common glue. (See page 12).

Hand-picking—Hand-picking of galls on evergreen trees infested by gall-making aphids is advisable when the infestation is light and the trees are small. The galls should be removed early in the season before their occupants emerge. It is desirable to destroy by fire all the galls collected, especially if they are near maturity. Where the infestation is severe or the trees are large, hand-picking is out of the question.

Nicotine Sulphate—After growth starts and when it is too late safely to use oils, good results have been obtained by the use of nicotine sulphate at the standard strength (one pint of 40 per cent nicotine sulphate to 100 gallons of water, plus four pounds of laundry soap). The application must be made just before the aphids have enclosed themselves in the galls.

CAUTIONS

The spraying of conifers is generally looked on as an uncertain proposition; nevertheless, when the tree is doomed unless some remedial measure is taken, one should not hesitate. The above sprays have been in use experimentally for several seasons, and to date no serious results have followed their application in our tests.

Whatever spray is used, it is important to hit the tip ends of the limbs and especially their undersides, since this is where the majority of aphids seek winter quarters.

Following the application of any of the above sprays, the "bloom" will be removed from the tree and the foliage will be, for a time, of an almost uniform green, lacking the bluish cast which renders some of the spruces so attractive.

One should clean the spray tank thoroughly before mixing any oil preparation. A dirty spray tank may spoil an entire batch of spray material. Spray rigs which have been used in applying lime-sulphur should be cleaned with special care before being used to mix and apply any oil spray.

