

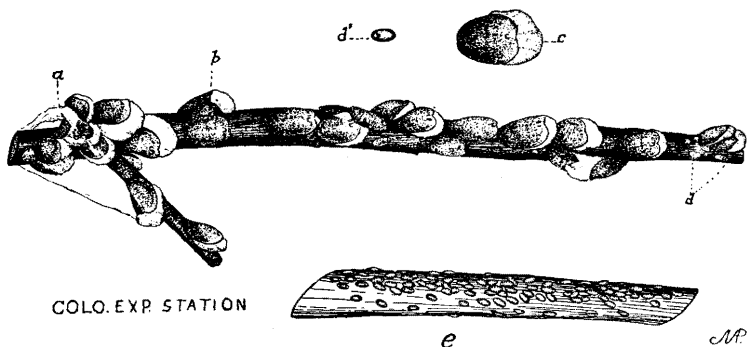
# The Agricultural Experiment Station

FORT COLLINS, COLORADO.

## THE COTTONY MAPLE SCALE.\*

(*Pulvinaria innumerabilis*)

BY S. ARTHUR JOHNSON.



THE COTTONY MAPLE SCALE: (a) ovisac opened to show eggs; (b) females with cottony mass partly secreted; (c) slightly enlarged female; (d) parasitized winter form; (d') the same slightly enlarged; (e) hibernating winter form. All except c and d' natural size. (Drawn by Miss M. A. Palmer.

The cottony maple scale is a rather common pest on soft maple and some other trees, especially those which are planted in parks and along the streets for shade and ornamental purposes. It belongs to a group of very much specialized insects which have a habit of spending a very large portion of their lives attached to one place on the plant on which they live. During the greater portion of their existence they are covered with a shell of greater or less hardness, which often resembles very closely the surface of the food plant. Owing to these characteristics and the fact that they look so little like insects, they are commonly overlooked by all except those who are making a specialty of studying them. The injury is done while the insect is taking its food. To do this it thrusts hairlike bristles from its mouth into the plant tissues and draws out the sap.

\*Based on Bulletin 116 of the regular series.

The cottony maple scale has attracted considerable attention during the past few years on account of its unusual abundance and the injury it has caused in a number of widely separated localities. It is found throughout the middle zone of states in the eastern portion of the country and in many of the far western states. It is a native of this continent and has long been widely distributed. Ordinarily it does little injury because the numbers are too small, being kept in check by its natural enemies. Sometimes these fail for some reason to perform their useful offices and the scale increases in marvelous numbers.

The adult form of the insect is most easily recognized during May and June when it secretes a white cottony mass of wax about the size of a pea from under the scale. These masses appear on the twigs and small limbs. They may range in numbers from a few scattering individuals to where the under sides of the limbs are nearly covered with them. The masses at this time are more commonly found on the lower limbs and most often on the under sides of these. In the center of the fluffy masses the insects lay several hundred tiny oval nearly white eggs and then die. The egg laying continues with different insects from the latter part of May till about the first of July. The eggs hatch in June and July and the tiny young soon find their way to the leaves and begin to feed. Most often they settle on the under sides near the veins, but they are sometimes found on the upper sides and even the young tender shoots. Here they live during the summer without changing their position. It is during this season that the injury is done to the leaves. The old deserted cottony masses still cling to the limbs and are sometimes to be found there for more than a year after they were formed. They, of course, do no injury. In August and September the male scales develop into tiny winged insects, but they soon afterward die.

The females remain on the leaves until October and then migrate back to the twigs and limbs. At this time they are a little over a sixteenth of an inch in length. They fasten themselves for the last time, usually lengthwise the twig, and more often than not on the under side of it. During this fall migration a great many are lost by clinging to the falling leaves and otherwise failing to secure good hibernating places.

Throughout the winter the scales may be found in this position and during this time they take but little if any nourishment.

As soon as the sap begins to flow in the spring they begin to grow. Their color is almost exactly that of the bark and they escape unnoticed. By the latter part of May or early in June they are full grown and measure about three-sixteenths of an inch across. The waxy mass is secreted from the under sides and this gradually raises the insect until it stands at an angle of sixty degrees or more to the twig on which it rests.

As already stated the insect does most injury to soft maple

trees, but it is also sometimes very abundant on black locust and Virginia creeper. Nearly fifty food plants are known, but commonly only the ones mentioned will be so badly infested as to need treatment.

## REMEDIES.

The scale is so well protected at most stages of its life that it is very hard to kill without injury to the tree. The best time is during the winter while the trees are in a dormant condition. An insecticide can then be used which is strong enough to kill without injury to the tree. All parts of the tree can be reached, which cannot be done when they are in foliage. The amount of insecticide required is very much less than in summer.

The insecticide most commonly used is kerosene emulsion. This is a mixture of kerosene and water accomplished through the use of soap and made according to the following formula:

Kerosene .....	2 gal.
Soap .....	$\frac{3}{4}$ gal.
Water .....	1 gal.

Dissolve the soap in boiling water and while still boiling remove from the fire and add the kerosene. Then with the force pump, pump the liquid back on itself for five or ten minutes until the mixture assumes a creamy consistency and no free oil rises to the surface when the emulsion is permitted to stand a few minutes. This makes the stock solution. If the oil refuses to emulsify after considerable agitation, the mixture may be put over the fire and warmed somewhat. If this is done, great care must be taken that the oil does not boil over or serious results may follow. If the soap is first dissolved in two gallons of water the resulting mixture will be warmer and more apt to emulsify readily.

Common laundry soap is most readily obtained, but any brand will answer. Whale-oil soap will do equally well. If the water is hard or alkaliied it will be necessary to use a larger portion of soap, or to treat the water in a way to soften it. Soft naphtha soap is sold by which a good emulsion may be made cold or by only slightly warming the water. It is necessary to use fifty per cent more of the soap when used in this way. This is a good method where large quantities of the emulsion are to be used and the task of heating the water is a serious problem.

For use on this scale the original stock solution must be diluted until there are four gallons of water to every gallon of kerosene. That is, the original stock solution given above will make ten gallons of emulsion ready to spray on the trees.

The application is made by use of a spray apparatus using a fine misty spray. The nature of the equipment will depend largely on the amount of work to be done. For a few trees a small bucket pump will probably be all that is required. In applying the emulsion, the secret of success is in the thoroughness

of the work. It will be necessary to go over each limb from two sides and beneath, and spray until the emulsion drips. After this the tree should be examined and all the missed spots retouched.

Since the infestation is not always sufficiently severe to require treatment, it will be necessary to make an inspection before the task is undertaken. In parks and large grounds it is often wise to select those trees or groups which bear a great many of the insects and permit nature's remedies to take care of the rest.

**SUMMER TREATMENT.**—Sometimes the pest is so abundant that a summer treatment is desirable. When this is done, the emulsion must be used much weaker than in winter or serious injury will be done to the foliage. The best proportion is probably one gallon of kerosene in fifteen of water. In a very few days after the newly hatched larvae have settled on the leaves they become covered with a scale and are so protected that this strength will not kill them. Since the eggs hatch most abundantly during June and July, it will be necessary to make more than one spraying in order to catch the young while they are susceptible. To do thorough work it will be well to begin about the middle of June and continue the applications at intervals of about two weeks during July.

In cases where the number of trees is small or the insects are on Virginia creeper or grape, they may be treated as soon as the cottony masses show themselves, by trimming out twigs and branches, where such an operation will not mar the beauty of the plant, and thoroughly soaking the remaining masses with kerosene emulsion which is one-fourth kerosene. This emulsion may be applied with a brush or sponge and must, of course, be kept from the foliage, which it will destroy.

A fuller but more technical account is given in bulletin 116 of the regular series.