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The Oak Scale

AND

Its Control

BY

W. F. TURNER

Assistant Entomologist

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THE OAK SCALE AND ITS CONTROL.

(*Lecanium quercifex* Fitch)

By W. F. TURNER, *Assistant Entomologist.*

The principal street and shade trees of Alabama and the other Gulf States are the oaks. Of these the water oak (*Quercus nigra*) is by far the most important. There is probably not a single city in the State in which a large proportion, if not the majority of the street trees do not belong to this species. Willow oaks (*Q. phellos*) are occasionally found, and in South Alabama the live oak (*Q. virginiana*) is common. Neither of these, however, is as important as is the water oak.

After the water oak has attained some considerable size it is seldom seriously injured by insects. The young trees, however, are often found to be stunted and weak without any apparent reason. Such trees are in most cases being injured by the attack of one of the soft scales (*Lecanium quercifex*). The injury is not confined to the young trees, but is much less apparent on the older trees. The insect which causes this damage is seldom noticed except in the spring, when for a few weeks the twigs are covered by the large scales of the mature females. Nevertheless, the pest is becoming more and more abundant every year and constitutes a very serious problem in the care and maintenance of shade trees.

The oak scale was first described by Fitch, in 1858, from specimens taken on white oak (*Q. alba*). It is found throughout the United States and even in Canada and has been taken on black oaks (*Q. velutina*), red oak, (*Q. rubra*), scarlet oak (*Q. coccinea*), willow oak and live oak. It has also been taken on iron wood, chinquepin and elm. However, its chief food plant appears to be the water oak, and its principal damage is confined to the South Atlantic and Gulf Coast States.

The adult females begin laying eggs in the early part of April*. In 1911 egg deposition commenced about April first, in 1912 about April thirteenth. The egg laying period continues for about three weeks. In 1912 it covered twenty days, ceasing on May third. Only three actual counts have been made of the number of eggs laid by one of these females. The first laid 2,245, the second 5,000, and the third 5,262 eggs. The smallest

*All data given in this circular is for the latitude of Auburn. The dates given are probably late for South and early for North Alabama.

number of eggs was laid by a very small female and the average is undoubtedly as high as 4,000.

The eggs are oval, slightly tapering at one end and are very light yellow brown in color when laid. In the mass they have a rosy hue. The color deepens just before hatching. The eggs average .29mm. by .16mm., and are plainly visible upon the loosening of the mother scale.

Hatching commenced in 1910 about April twenty-sixth, in 1911 about May fifth, and in 1912 about May sixth, and continued through a period of about three weeks in each case, ceasing in 1912 about May twenty-seventh. Thus the incubation period would be about twenty-six days for the last, as well as for the first of the broods. Practically every egg hatches, the unhatched probably constituting less than one-tenth of one per cent of the total number laid. In the majority of batches examined every egg hatched. In a few instances, the scale of the adult adheres so closely to the bark that the young are unable to escape, and in such cases all the young perish. Occasionally a few young are found dead under the parent scale, although the majority have escaped. This condition, however, is exceptional.

The young nymphs are very active and may travel considerable distances before settling. In one case several nymphs were found settled on leaves which were seven feet away from the nearest adult scales. In another instance a few young scales were found on the leaves of a small tree which had not been infested the year before, and which was twenty feet from the nearest infested tree. It seems quite probable that in this latter case the scales were carried from one tree to the other, possibly by birds, or large insects, or perhaps by the wind. In the first case, however, the young undoubtedly crawled to the leaves as these were separated from the parents by a slender, smooth-barked branch, over which it would be comparatively easy to travel. Examinations were made of several heavily infested trees, and while the branches and twigs were literally covered with the migrating young, none could be found on the main trunk more than six inches from the bases of the branches and perhaps a foot from the nearest adult. It seems doubtful whether the young ever crawl to the ground, at least in the case of large rough-barked trees. The nymphs remain active for a considerable length of time, even after they reach the

leaves. In the laboratory such nymphs were found unsettled five days after hatching.

All the living young finally settle on the leaves. There does not seem to be any great difference in the choice of sides. Of 435 nymphs on ten leaves of the water oak, 247, or 57.8 per cent were on the upper surface and 188 or 43.2 per cent on the lower. The leaves of the willow oak are larger and coarser than those of the water oak, and on them, of 932 nymphs, 394 or only 42.2 per cent were on the upper surface and 583 or 57.8 per cent on the lower surface. The young settle principally along the main or larger lateral veins of the leaf, with the body parallel to the vein. However, if the infestation is very severe, they settle promiscuously over the surface. Undoubtedly a large number of nymphs never settle and of those which do, many probably die. Laboratory experiments to determine the percentage of settling were unsuccessful. In one case, at the end of five days, two out of fifteen young had settled, two were moving and the remainder were dead. This experiment was discontinued because the leaves had become too dry for food.

The nymphs remain on the leaves until fall, apparently not changing in size but remaining in the first stage throughout the summer. They then migrate back to the small twigs, seldom going more than an inch or two from the base of the leaf on which they were located. This fall migration is a rambling, indeterminate movement. The first individuals leave the leaves during the last of September, and the migration continues throughout the fall and early winter. In a few cases, in which the trees did not shed their old leaves until spring, when the new ones pushed them off, nymphs were found on the old leaves in March. Probably a large percentage of the nymphs are shed with the leaves and never reach maturity.

The young remain dormant on the twigs until February, when as the sap begins to flow again, they begin to grow slowly. This growth continues until the last of March, when it becomes very rapid in the case of the female scales. They soon attain their full adult size and in this condition are covered by a thick, tough, scale, which protects them much more fully than the young were protected. Soon after attaining full size, the females begin to lay eggs and the life cycle is complete. We have never observed the male, and are uncertain just when mating occurs.

There are several natural enemies which aid in controlling this pest. At least two Hymenopterous parasites have been captured, one on the hibernating nymphs, and one on the eggs. The species have not been determined. There are also several lady beetles which feed upon the young stages. The most important of these lady beetles at Auburn is the "twice stabbed lady beetle" (*Chilocorus bivulnerus*).

It will be easily seen, from the foregoing sketch of the life history of this insect, that the only time at which it can be profitably treated is during the late winter, preferably just before the leaves start. At this time the young are collected on the twigs and there are practically no leaves to interfere in spraying. Also much stronger spray solutions can be applied at that time than could be used on the foliage. Lastly, the insects are still small, and soft, and are not covered by a tough impenetrable scale.

We have tested several spraying materials on this insect. Many of these, which at first thought would be expected to control the pest, have proven to be absolutely valueless. In the spring of 1910, several trees were sprayed with lime-sulphur wash. This was a home-made wash, formula 16-16-50, such as would be used against the San Jose scale. This was applied after the trees had begun to leaf out, and while the scales were in the fully matured stage. The experiment was unsuccessful, as the spray had apparently no effect whatever on the insects.

In 1911, four materials were tested. These were crude oil emulsion, 1 to 7 and 1 to 9; kerosene emulsion 1 to 7 and 1 to 9; sulfur-baking-soda wash, and sulfur-sal soda wash. The two latter were made up according to formulas given by Prof. H. A. Surface.‡ We experienced considerable difficulty in preparing them, and were never able to obtain a perfectly clear solution. These four materials were applied on May thirteenth. At that time the leaves were about half grown, and the Lecaniums had all finished egg laying. A few of the eggs had hatched. None of these mixtures gave any apparent control. The sulfur-soda washes both burned the foliage severely, while the crude oil emulsion remained as a disagreeable, sticky coating on the leaves until fall.

In 1912, the spray materials were applied earlier in the season, on March eighteenth. The insects at that

‡ Surface, H. A., Zoological Bulletin, Vol. V, No. 11, Div. Zool., Penn. Dept. Agr., Harrisburg, Penn. p. 334.

time were still small and soft. They were, therefore, in a much more susceptible condition than on either of the previous years. Three solutions were used; Schnarr's Insecticide 1 to 20, and emulsions of Junior Red Engine and Diamond Paraffine Oils. These emulsions were prepared according to Yother's formulas.† They were both used at strengths of 3 per cent and 4 per cent oil. All of these materials gave about equal results, killing all of the scales hit.

On April 4th, 1912, other applications were made, using Schnarr's Insecticide 1 to 20 and Diamond Paraffine Oil emulsion, 4 per cent oil, made up with Good's No. 3 Soap. At this time the trees were beginning to put out leaves. These sprayings were not as successful as the earlier ones, since the leaves protected many of the scales from the liquid. Both sprays burned the tender foliage rather severely. The Diamond Paraffine Emulsion causing the most damage. By mid-summer, however, none of these trees showed any injury to the foliage while the infestation was perceptibly decreased.

We therefore, recommend a thorough spraying in March using any of the three following formulas:

(A). Schnarr's Insecticide 1 to 20.

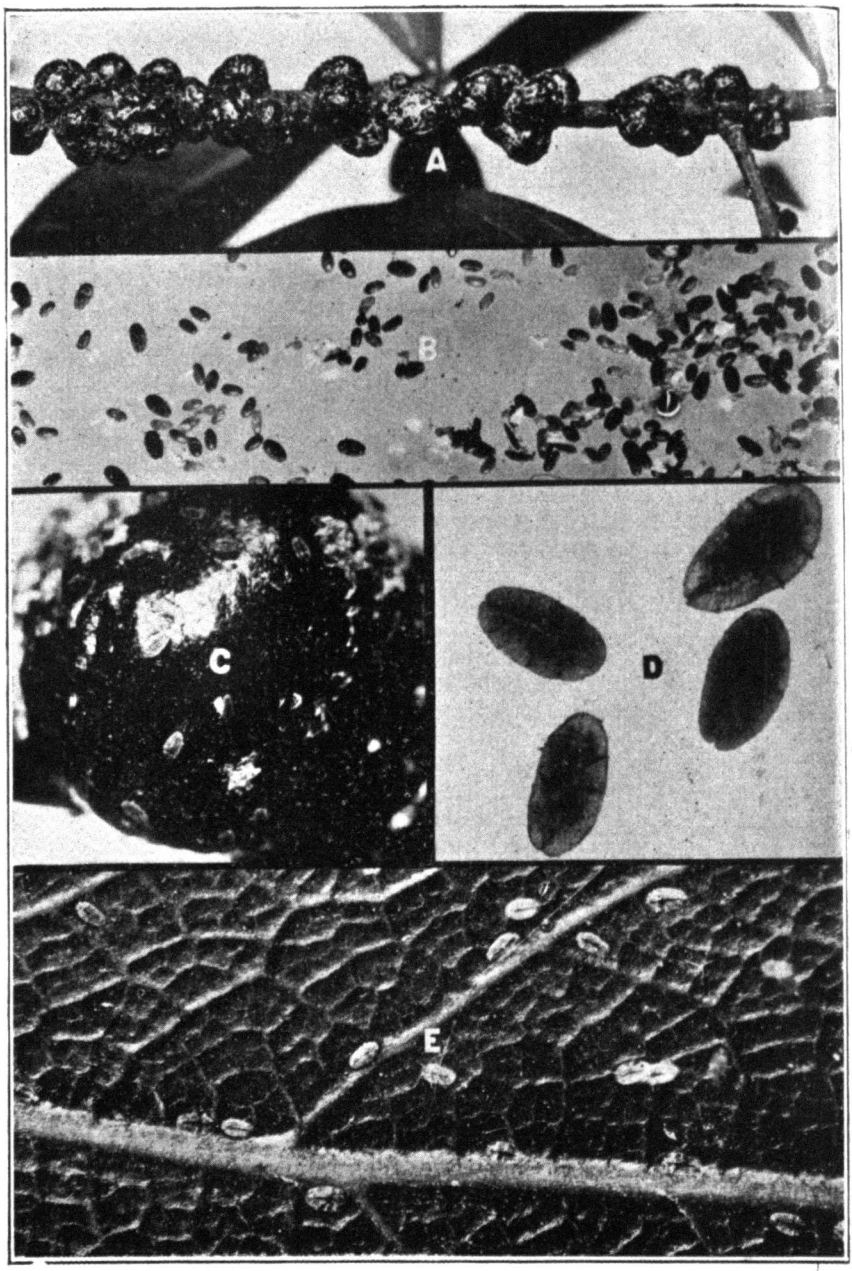
(B). Junior Red Engine Oil 2 gals.
Whale Oil Soap ------1 gal.
Water ----------50 gals.

(C). Diamond Paraffine Oil 2 gals.
Whale Oil Soap -----1 gal.
Water ----------50 gals.

In preparing (B) and (C) the oil should be slowly added to the soap solution and stirred thoroughly as added. When the two are thoroughly mixed, about 3 quarts of water should be added, slowly, and the whole emulsified by stirring. After the emulsification is complete the whole may be diluted to 50 gallons and is then ready to apply.

Great care is necessary in applying the spray. The young are all located on the very small twigs of the preceding years' growth and it is necessary to soak the tree thoroughly, wetting these twigs on all sides in order to hit all the scales. Such careful spraying should be entirely successful and, as the scale spreads very slowly from tree to tree, one application every four or five years will probably be sufficient. A repetition of the spraying in February 1913 gave very satisfactory control. Thorough, timely spraying will control this pest.

† Yothers, W. W. Crossman, S. S., Florida Fruit Grower, April 28, 1911.



THE OAK SCALE

Fig. A, Mature females on twig, May; Fig. B, eggs, egg shells and young; Fig. C, female scale with young crawling over it; Fig. D, winter stages from twig; Fig. E, summer stage on under side of oak leaf. Fig. A. natural size. B, C and E enlarged 10 diameters; D, 20 diameters. All original.