

Life History and Control of Latania Scale on Avocado

Howard L. McKenzie

*University of California Citrus Experiment Station, Riverside, California
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Latania scale is probably the most important insect pest of the avocado in California. It has increased rapidly in the last few years and has caused damage in many groves. The scale is usually most abundant on the branches and twigs, but as the infestation increases, may also be found on the leaves and fruit. The smaller branches may be killed by a heavy infestation. The marketing quality of the fruit is impaired because of the presence of the scale on the rind. As the fruits mature the insects cause protuberances to extend from the rind down into the flesh, and when the rind is removed, corresponding depressions are left in the flesh.

Distribution and Hosts

D. B. Mackie of the California State Department of Agriculture reported the latania scale as being rather generally present in California on avocados in San Diego, Orange, and Los Angeles counties, with only a few light infestations found in Ventura County. He also gave statistics regarding the prevalence of the scale in each county during 1928 and 1930. Mackie also included a list of the host plants of the world on which the insect has been taken. This list includes some 163 host species and will be omitted from this paper. With regard to host plants, latania scale in southern California has not as yet become widespread. Aside from the avocado, which appears to be its primary host, this scale has been found only on *Grevillea thelemanniana*, canna lilies, and gladiolus corms. However, an extensive survey of host plants has not been made.

Life History

The yellow eggs of latania scale hatch within a few hours after they have been laid. The first-stage larva, or crawler, does not, as a general rule, migrate far from the parent insect. It usually settles within eight hours and starts to secrete wax, which eventually becomes the scale covering. The only noticeable external change that takes place after settling is the gradual expansion of the insect and its wax covering. The total length of the life cycle of this insect from egg to adult requires approximately two months (56 to 65 days) in summer at Carlsbad.

Female scales, isolated from birth beneath gelatin capsules, produced young after two months. On the basis of this experiment, and because no male specimens have been found, it is believed that the insect normally reproduces without fertilization.

Birds, insects, and men are responsible to some extent for the dispersion of this insect. Wind may also carry the individual crawler, or a leaf bearing a colony of them some distance.

Parasites and Predators

The common chalcid *Aphytis diaspidis* (Howard) is the only hymenopterous parasite that is known to attack the latania scale in California.

The two-stabbed ladybird beetle (*Chilocorus bivulnerus* Muls.) feeds on latania scale. It measures from 1/6 to 1/5 inch in length, is nearly hemispherical, shining black, and has two red spots on the wings. The eggs are orange. The larvae are black and are covered with long branched spines. When full-grown they measure about 1/4 inch in length. The larvae are also predacious upon the scale insects. Two other species of ladybeetles of less importance also feed on the latania scale.

Control

In June, 1931, several tolerance tests with fumigation were made on seedling avocados on the Citrus Experiment Station grounds. Some of the tender growth was burned with the higher dosages, but the injury was not serious. Further tests were made later in the same planting to determine what effect seasonal changes would have on fumigation results. There were no insects on the trees on the Experiment Station property, so scale counts could not be made. However, in September of the same year, tests were made at Encinitas, California, which indicated that fumigation gave a satisfactory kill of latania scale at all dosages used (18 to 24 cc). With the exception of the highest dosage (24 cc) no tree damage occurred.

Fumigation tests, with both liquid cyanide and powdered calcium cyanide, were conducted during August and September, 1931, by D. F. Palmer, Agricultural Inspector at Carlsbad, and A. F. Kirkpatrick.

Tests made in 1932-33 with several different oil sprays gave little promise of effectively controlling the latania scale on avocado, and at the same time a considerable amount of tree defoliation occurred, as well as a possible inhibition of the set of fruit. A medium oil (Grade 4) applied at 2 per cent strength is as heavy as may be used with reasonable safety and at the same time secure a fair degree of kill on the scale.

As compared with citrus tree fumigation, which is a very old procedure, a number of new factors are involved in the fumigation of avocado trees. One of these factors is the size of the avocado plantings, many being but from one to five acres in extent. Still another factor is the greater danger of breaking the avocado branches as the tents are pulled over them. This danger is obviated in part by the use of a light-weight tent, made from 350 sheeting. (The term "350 sheeting" means that 3½ yards of material 36 inches wide weighs 1 pound, or 4.57 ounces per square yard.) For the grower who has only a few acres of avocados, one or more tents may be purchased, and with the cooperation of a neighbor the tents may be hoisted over the avocado trees by means of bamboo poles or with specially constructed derricks. By this method, a few trees may be fumigated each night. For such small plantings powdered calcium cyanide may be used, with no particular hazard in connection with the handling of it and with no special apparatus necessary for its use.

The fumigation dosage for a particular tree is measured by means of cups of different sizes, ranging from 1 ounce to 5 or 6 ounces. The amount of calcium cyanide, computed by the measurement of each tree, may be determined by the use of a fumigation chart. For avocado trees, the dosage used is 2 ounces of calcium cyanide for each of the units called for in the regular citrus-tree schedule.

When powdered cyanide is used, it is placed in a tin can (a 5-pound Cyanogas can is often used) with a perforated bottom and with a long handle attached for shaking the material on the ground beneath the tree. The exposure is 45 minutes.

Figures for calculating the **distance over** the tree are marked on the fumigation tent. When the tent has been thrown over the tree, the figures nearest the ground, on each side of the tree, should be added. The **distance around** the tree may be measured by a tape.

Fumigation should not be carried on when the wind is blowing sufficiently to move the tents, or when the foliage or ground is wet, or in the warm, bright sunlight. Fumigation is most effective during the months of July, August, September, and October. Winter fumigation is ineffective.

For larger plantings fumigation with liquid HCN is recommended because of the larger number of tents required and the consequent greater overhead cost against a single planting. In such work, where thirty or more tents are employed, the use of liquid HCN is preferable to the powdered calcium cyanide, because of the more rapid charging of the tree by the liquid and the lower cost of the material. Experiments in 1934 with liquid HCN under the lightweight tents used in avocado fumigation have proved effective in controlling the latania scale providing the 18 cc schedule is used.

Perhaps the parts of the avocado tree most susceptible to fumigation injury are the blossoms and young fruit. The tender growth may burn but new growth rapidly appears and the tree soon recovers. In the case of blossoms and young fruit, however, such is not the case. Much remains to be learned about the fumigation of avocado trees, and this subject is still under investigation by the Citrus Experiment Station.

Question: Would you advise fumigating during early April or wait until July? Would it be detrimental to blossoms, etc.?

Answer: We haven't carried on tests in April, although we do plan to do that this year, and then I might be able to tell you. At the present time it seems desirable to proceed slowly with fumigation while the trees are in bloom.

Question: What form does the scale take on the fruit?

Answer: The presence of scale on the rind of fruit, causes depressions and as the fruit matures the scales leave corresponding holes in the flesh. It is most abundant on the branches and twigs and as the infestation increases it works its way out onto the fruit.

Question: Does it affect different varieties?

Answer: Yes.

Question: Puebla and Fuerte? My grove is planted about every other tree Puebla and

Fuerte. There is quite a lot of scale on the Fuerte but never on the Puebla.

Question: Will it kill a tree?

Answer: Yes, I have seen one tree that was completely killed, and others where many of the larger branches were killed outright. The scale hasn't been here long yet.

Question: Is it any worse in orchards where the limbs are down on the ground than when the limbs are pruned up?

Answer: No, I haven't found it so.

Question: I have a tree where the limbs on the ground have more scale than on those high up.

Question: Does latania scale bother the ivy vine—looks just like greedy scale.

Answer: You can't tell any difference between ivy, greedy and latania scale until you make a microscopic examination.

Questioner: I had both examined and they said it was the same.

McKenzie: Is your avocado grove around La Habra and Whittier?

Answer: At Garden Grove.

McKenzie: In this particular area you have ivy, greedy, and latania scale, all mixed. I always mount several specimens from a twig or fruit to make an accurate determination. The greedy and ivy scales do attack avocados.

Question: Does the greedy scale attack the Puebla?

Answer: I have never seen it, although it is very probable that it does when a grove is generally heavily infested.

Question: Is treatment of all three scales the same?

Answer: Yes, treatment is the same.

Question: How does temperature affect the scale?

Answer: Colder temperature, of course, slows down reproduction. Also during the cold temperature the fumigation treatment does not give as good a kill.

Question: Does a colder winter cut the amount down?

Answer: Yes, the mortality is usually greater during the winter season.

Question: What treatment do you recommend for the greenhouse thrips?

Answer: A highly refined light medium oil, of a viscosity of 70 seconds may be used at 1% per cent with 1 pint of nicotine sulfate plus 1 pound of casein spreader to 100 gallons of diluted spray. Two applications may be necessary, with an interval of 2 or 3 weeks. A second application is necessary in order that the young thrips may be killed when they hatch from the eggs.

Question: How do you account for my having never seen any scale until this year, and when I did find scale it was only on one or two trees right out in the center of the orchard?

Answer: Hard to explain, although birds will land on a branch and the crawler will crawl onto the birds' feet. The birds then fly to a tree several miles away, alight, and the crawler of latania scale will crawl off onto the branch. Since the latania scale are all female specimens an infestation is rapidly built up.

Question: Is fish oil preferable to light oil?

Answer: No. We have tried fish oil and it wasn't effective at all.

Questioner: I have gotten better results with fish oil than any other, but it is more expensive.

McKenzie: Our work with fish oils was very unsatisfactory.

Question: What oil, and what strength do you recommend?

Answer: If you are going to use oil we recommend a light medium oil (grade 4) applied at 2 per cent strength. This is as heavy an oil as may be used with reasonable safety and at the same time secure a fair degree of kill on the scale.

Question: Will scale on wood be expected to stay until life of tree unless taken off?

Answer: Once the scale has settled and secreted wax, it never moves after that. It will, however, drop off if killed by fumigation, etc., or when it dies of old age.

Question: Does white-wash kill scale?

Answer: I don't know, rather doubtful.

Question: Do you find any relationship between latania scale and Argentine ants?

Answer: No.

Question: What is the control of the avocado brown mite?

Answer: We have a good control for that. Dusting with sulphur applied at full strength is very effective. One application, if the infestation is general, followed by a spotted application is usually satisfactory in controlling the mite.

Question: What are the hours for dusting?

Answer: In the evening, when the wind isn't blowing.

Question: Does it make any difference as to how healthy the tree is as to the development of the scale?

Answer: They seem to prefer a healthy tree.

Question: What are the chances for development of a parasite to counteract latania scale?

Answer: We have little hopes of finding a parasite for controlling the scale. A search is being made by Mr. Compere at the present time to find a parasite of this scale, and the red scale of citrus.

Question: About the temperature of the atmosphere—in case of dusting for the avocado brown mite.

Answer: You can dust for the avocado brown mite most any time you want to. It doesn't

seem to make any difference.

Question: How do you recognize the avocado brown mite?

Answer: They first remove the green coloring matter from the avocado leaf. The leaf turns brown first along the mid rib, and as the infestation increases, the whole leaf turns brown. The leaves eventually drop causing considerable damage to the tree. The mite is generally brown in color, and not reddish as in the case of the citrus red mite. The avocado brown mites are easily controlled, I believe, because they confine their feeding to the top side of the leaf, thus are more easily hit by the sulphur dust.

Question Asked of Mr. Blanchard: What has been your observations of the effect of fog on pollination of avocados?

Answer: I have made no observations as to the effect of fog.

Question: On a quite heavy soil what might be the cause of several trees five years old becoming pale color almost yellow with very new growth?

Answer: That would depend on what the other practices are. On some of the heavier soils those symptoms would seem to indicate over-irrigated condition. That is the first lead. Lack of nitrogen would be another thing. Probably best to recommend getting a soil tube and auger and see what is present.

Question: Is it advisable to top-work a sun-blotch tree?

Answer: No.

Question: Why can't the Duke and Panchoy avocado be eliminated?

Answer: Panchoy is only on list for amateur plantings. Some people like a large fruit like that. No apparent reason for taking it off that list. The Duke is also in much the same position. Duke is a newer fruit—a green fruit— Mexican fruit and so far as we know today is as good as any of the Mexicans. It may be this particular grower has had unfavorable experience with it. Quality perhaps is not as good this past season as it has been in past years. Duke has very great value in certain districts because of its ability to withstand severe cold and severe winds. Shows less damage to wind than any variety I know of, I am not particularly defending the Duke but if you need a good Mexican variety for the interior, the Duke is probably as satisfactory as any of them.

Question: How about the marketability of the Weiss and Ryan?

Answer: No data on them.

Question: How much manure is it advisable to use on mature trees? When should it be put on? Is it necessary to put it on every year in deep, rich soil?

Answer: There are a few very fortunate areas where you can get by with cover crop and possibly every other year use manure—say ten tons on mature trees.

Question: When should it be put on?

Answer: We like to put it on in the fall. It requires several months for the material to become available. Like to have material on early enough to break down and become available to the feeder roots in the spring months.

Question: Does cultivation of an avocado grove help or affect in any way the trees' bearing?

Answer: From what I know of reproduction I can see no gain that you get from cultivating trees in bearing and it might, if carried on to excessive degree, result in less production if feeder-root-system is interfered with, but there are certain benefits derived from certain kinds of cultivation. You have got to cultivate some to get the manure into the ground.

Question: Is it practical and likely to be satisfactory to work over a tree with grafts—having sunblotched top and seemingly good trunk below the bud union?

Answer: No.

Question Asked of Miss Algrer: How do you meet the main objection of women that the avocado is a fattening food?

Answer: Simply leave out several starches and some of the other fats which do not carry with them the rich vitamin content.

Question: In selecting Mexican for seed stock has size and shape any advantage and are Mexicans the best of seed stock?

Answer: No, I haven't discovered that—I don't know.

Question: Are Mexicans the best seed-stock?

Answer by Mr. Blanchard: I tell you what I think we did discuss. That is the question of compatibility or affinity between stock and scion. I stated that it appeared to me in line with study of other kinds of trees that it might be one of the factors responsible for failure of some varieties—like Lyon for instance.

Carter Barrett: Just a little bit from my own experience. I have had quite a bit to do with propagating trees. My own feeling, without any question is that medium to large, smooth surface, conical Mexicans make the best type of seed-stock. I also have found on quite a large scale experimentation that Ganter seedlings make very satisfactory root-stock, much more so than some others. Mrs. Gano is very strongly convinced of that. One of my hobbies is to promote study of root-stock and I think many cases can be traced to improper root-stock. There are a number of nurserymen starting some cooperative work in that connection.

Calkins: One thing I can tell about in my experience in this. The thinner the bark, the more trouble in budding. Thin bark trees are the ones that are harder to graft.

Question: I have several trees hit by frost—few young trees—open to sunburn. Will painting with whitewash be necessary or should I pinch or prune side branches to help top growth? What is your method of protecting from sun-burn after top-working?

Answer: Well frankly, I don't like whitewash. I believe most of the whitewashes are not sufficient protection against severe conditions. Ordinary whitewash often has a detrimental effect on bark. My own pet method, if anyone wants to call it that, is the use of burlap. It may need to be one thickness or two, depending on type of burlap. It is most adequate protection; after all any protection doesn't work when temperature gets up to 110 and 115. In some of the inland districts it isn't any protection at all.

Question: In a soil analysis how much potash should a soil show for an ideal avocado grove, nitrogen, potash, etc.?

Answer by Dr. Haas: No one knows. All we know or we think we know— what is good for citrus. Avocados get along fairly well with what citrus will get along with. The point is that the present state of our knowledge does not throw much light on that. What I recommend and I am trying myself—is to try some practical fertilizer test on your own place. The way to find out whether your trees will benefit by more phosphoric acid is to pick out a row and give them a good big shot—give certain trees certain amounts of phosphoric acid and another bunch none, and you can tell in a year or two whether they are responding with a better crop. Soils vary.

Question: Is there any known way to stimulate buds for rebuilding a tree, by bruising or by acid burn?

Answer: Yes, girdling or partial girdling. This will stimulate buds in the neighborhood of the girdle. Cut through the bark—partially girdle it.

Question: In top-working in Whittier district what is the best month and why? How late in spring and is it more difficult to get Lyon grafts to grow than other varieties?

Answer: Well, it would probably be in the spring. Better results are usually obtained in the spring. Depends on the method and the operator. Mr. Calkins, I believe, can do it any month in the year—he did some work on the 7th of August, and got them to grow. One other factor, the question of when your scions or buds may be in best condition. A short period as a rule in the spring and then they come on again in summer and fall. It is certainly more difficult to get Lyon grafts to grow—that is recognized by everybody.

Question: What are some of the newer promising varieties?

Answer: That depends. We are not calling these new registered seedlings "varieties" until they have been propagated to some extent. When a new seedling has received a name and has been propagated in different places, it then graduates into a commercial variety. Several that did graduate into the Variety Check-list this last year, the Hazzard is one. It has an excellent bearing record on Mr. Hazzard's place at Vista. Another one which has graduated but which I don't feel has been well tested out is the Linbeth. It was originated by Dr. Lincoln Rogers at Fallbrook. Unfortunately with me it has this year dropped its fruit before being mature. The Leucadia is a black Mexican, originated at Encinitas. We don't know yet how well it will grow inland. So far has grown as far East as Ontario. Leucadia bears well regularly. Matures earlier than the Puebla. Has a small to medium seed.