

Latest Developments in Avocado Pest Control

H. L. McKenzie

University of California Citrus Experiment Station, Riverside, California

Paper read at Avocado Growers' Institute La Habra, March 10, 1933.

The avocado, as most avocado growers now know, is attacked by many insect pests. One of these is the omnivorous looper, **Sabulodes caberata** Gn. This insect has been the most important leaf-eating pest of the avocado in the last year or two and has been numerous enough in some cases to strip the tree of practically its entire foliage. A bacterial disease has, however reduced its population to a minimum so that at this season (February,, 1933) it is almost impossible to find any stage of the insect. This looper is generally distributed throughout California and attacks a large number of host plants, as its name suggests. It is a native of California and was originally described here by Guenee in 1857.

The Moth. The moths are dull yellow and have a wing spread of about 2 inches. They are characterized by small dots and by the dark bands along the outer margin of the wings. The female moth is somewhat larger and slightly darker in color than the male. They are nocturnal in habit, that is they fly and feed at night, but may be found during the day clinging to the under sides of the avocado leaves with their wings spread. If disturbed, however, they will fly rapidly in a broken up-and-down movement for several yards and again alight, where they will remain perfectly motionless. Within 3 to 4 days after the moths emerge from the cocoons eggs are deposited to the number of from 300 to 400.

The Egg. An individual egg is characterized by many, usually 26, small, round protrusions around the anterior or large end of the egg. Just inside this circle of protrusions is another circle of less conspicuous ones. One whole side of the egg is plastered down and each egg mass may consist of from 3 to 80 eggs. Just after the eggs are laid they are metallic green,, but within 2 or three days will turn chocolate brown. The eggs hatch within 8 or 9 days, according to temperature and humidity conditions.

The caterpillar. The first stage caterpillar is pale yellow and very active. They eat only the epidermis of the leaf in this stage and not until they approach the second stage are they able to make definite holes in the leaf. If the caterpillars are disturbed while on a tree they will usually drop, spinning a silken thread as they fall so that they may hang

suspended in the air for some length of time by the support of this thread. There are five larval stages. Pupation occurs usually within 15 days after the last molt. Upon approaching pupation they will web two leaves together to make a flimsy cocoon, shrink considerably in size, and turn white. One of these caterpillars may consume one large avocado leaf in 24 hours. It takes a little over a month for the insect to develop from a first stage caterpillar to the time it pupates.

The Pupa. The newly formed pupae are pearl white but in 4 or 5 days a red collar forms along the antenna region. Later, as the wings develop, the anterior end of the pupa turns brown. The pupal period lasts from 13 to 22 days, according to climatic conditions. The pupae are encased in flimsy cocoons between the leaves. Many leaves are webbed together on the tree for this purpose.

PARASITES

The most important parasite of the omnivorous looper is **Habrobracon xanthonotus** Ashm. This small wasp usually attacks those caterpillars of the third, fourth, and last instars. First they sting the caterpillar just behind the head. This results in paralysis of the body of the caterpillar. Most of the eggs are found in the folds around the legs of the caterpillar. These small eggs hatch within a day or two and the eyeless and legless larvae start feeding. The larvae upon approaching pupation work their way beneath the now decaying caterpillar, spin small cocoons, and pupate. The cocoons are clustered together very tightly and each cluster may be made up of from 18 to 22 cocoons. The wasps emerge from the cocoons in 8 or 10 days, depending upon temperature and humidity conditions.

This parasite produced at least 70 per cent parasitism, yet this is not sufficient to be relied upon for satisfactory control where the infestation is serious.

Trichogramma minutum Riley is an egg-parasite of the looper. It is a cosmopolitan species and attacks the eggs of many moths and butterflies. The parasite oviposits in the looper egg and the adult wasp emerges in from 12 to 17 days, according to temperature and humidity conditions.

The parasite is not effective in controlling the avocado looper and its work should not be relied upon to the exclusion of mechanical control methods where the infestation is serious. Single specimens of two other parasites were found.

BACTERIAL DISEASE

The omnivorous looper is seriously attacked by a bacterial disease somewhat similar to the wilt disease of the silkworm. The caterpillars seem to be attacked by the disease just as they are preparing to pupate. Out of 88 caterpillars in a particular experiment only 2 pupated, the remainder had been killed by the disease. This disease has reduced the population of the looper to a minimum so that it is almost impossible to find a looper,

in any stage, in the field at this time of the year. Pure cultures of this disease are now preserved in agar-agar and beef-extract, so later it may be tried as a spray for controlling the looper.

PRELIMINARY CONTROL MEASURES

Light Trap Records

A 50-watt lamp was hung suspended above a galvanized tub filled with water with a thin film of kerosene on the surface. The traps were so designed that when the moth swooped toward the light it would fall into the tub. Since the initial number of moths caught in the traps was comparatively small as compared with the number left in the field, light trap experiments were discontinued.

Bait Traps

Bait traps were used with little success. A poison bait composed of diarmalt, water and yeast was used. The bait was then put into pans that were hung over one end of an irrigation standard. With the 25 pans used, after 10 days, 53 moths were captured.

Mechanical Control

Due to the fact that the bacterial disease may not be depended upon every year, and parasites, light, and bait traps are not effective in controlling the looper, mechanical methods must be relied upon.

Summary of Control Results

Mr. Hoffman's avocado grove at Encinitas was divided into 4 one-acre plots. In each of these plots 4 trees of different varieties of avocados were chosen. Fumigation tents were spread under the 4 trees in each plot and the live caterpillars on each tree were counted. The 4 plots were then dusted, and the caterpillars killed by the poison dusts dropped to the tents spread on the ground below the trees. These dead caterpillars were counted later. The data obtained indicate that comparable results were obtained through the use of basic and standard lead arsenate, and yet basic lead arsenate gave no tree injury or burn; but the percentage kill was only 85 per cent. Therefore two applications of basic lead arsenate should be made at one-month interval. By studying the life history of the insect it was possible to correlate the time of application of the poison with the life stage of the insect which was most susceptible to control measures. In this case the first application was made while the greatest number of individuals were in the young caterpillar stage. The second application was designed to reach the young caterpillars of the following brood.

***Amorbia essigana* Busck**

The next most important leaf-eating and fruit-scarring insect of the avocado is the

amorbia, **Amorbia essigana** Busck. This insect is quite numerous in the Encinitas and Carlsbad districts at the present time. It does not consume the amount of leaves that the looper consumes but its damage to the skin of the fruit cannot be overlooked.

The Egg. The eggs are laid in masses and each egg tends to partially overlap the one next to it. They are flat and are usually laid along the midrib on the top side of the leaf. In from 13 to 15 days the eggs hatch into small, yellowish, very active caterpillars. If disturbed they will squirm and fall to the ground. There are seven stages and yet pupation may occur after either the fifth or the sixth stage.

The pupae are webbed between two avocado leaves or else one leaf is curled so as to make a satisfactory place to pupate. The life cycle of this insect requires a little more than 2 months.

Basic lead arsenate is fairly satisfactory in controlling this pest, but it is hoped that a better toxic material may be found.

Paratetranychus yothersi McG.

The brown mite, **Paratetranychus yothersi** McG., is a troublesome pest to the avocado, and some years it causes serious damage to the trees. The eggs have a stalk and are supported by small, flimsy threads around the base. These small threads may protect the eggs from parasites and predators or they may be merely for support. The eggs hatch within 6 to 10 days, according to the temperature, into the first stage larvae.

The larvae is pale yellow and possesses only three pairs of legs. Usually within 3 days they molt and acquire another pair of legs. They now become the first nymph, or the protonymphal stage. Three days later they molt and become the second nymph or the deutonymphal stage, and finally in three more days they molt and become adult mites.

Sulfur dust is the most satisfactory material to use for controlling the brown mite on avocados. Two applications are usually necessary.

Aspidiotus lataniae Sign

The most important scale insect of the avocado is the látanla scale, **Aspidiotus lataniae** Sign. This scale attacks the leaves, stems, and fruit.

The female scale lays many eggs, which soon hatch into small crawlers. These crawlers migrate until they find a suitable place to settle. After settling, wax is secreted from their bodies and this wax eventually becomes the shell covering. In 13 to 17 days they molt beneath this wax covering and again start secreting another wax ring around the first wax portion. In from 22 to 31 days, another molt occurs and from this time on they are considered adults. It takes a little more than 2 months for development from crawler to adult. Hundreds of scales have been examined to find the male of **Aspidiotus lataniae** Sign., but as yet a male scale has not been found, so that reproduction may take place without fertilization.

The most satisfactory means of controlling latania scale is by fumigating with calcium cyanide dust, where this is possible. Trouble arises,, however, when the trees become

so large that a tent cannot be thrown over them, or where they are planted on a steep hillside. For this reason we have been working on oil sprays that will kill the scale and not injure the tree. A' medium oil, grade No. 4, at 2 per cent, seems to be the most desirable material thus far. Experiments with this oil show 85 to 95 per cent kill. The resistance of tree varieties to injury is a matter that needs further investigation, as well as other phases of the latania scale problem.

Thrips

The thrips, **Heliothrips haemorrhoidalis** (Bouché), on avocado may be satisfactorily controlled by several applications of nicotine sulphate spray. Further work on both life history and control of this pest is planned for the coming year.