

almost impossible to find it. In its last stage, the larva when changing into the pupa, casts the skin in like manner.

ADULTS: The adults are oval in shape and when freshly emerged are pale brown with a distinct darker line extending centrally down the back. They harden in from one to three days depending somewhat upon the amount of sunshine present when they are developing; then cut their way out of the cocoon, usually at one end, crawl up an alfalfa stalk and begin feeding.

Late in the summer some of the hairs and scales get rubbed off, causing the weevil to appear much darker in color. Before the following spring is passed many have lost nearly all the hair and brown scales and appear black with small irregular gray spots on the elytra.

A detailed description of the adult has already been published.¹

An examination of the type of *Phytonomus castor* Lec. shows that that species is not identical with nor even scarcely similar to *P. murinus* Fab.

CODLING MOTH CONTROL IN CALIFORNIA

By C. W. WOODWORTH

The recent Apple Show held at Watsonville, California, has not only the distinction of being the greatest exhibit in the history of apple growing, but marks a significant accomplishment in economic entomology. Watsonville is by far the greatest shipping point for apples in the world, sending out now about sixty cars per day, and the season's crop will be over 4,000 car loads. Only during the last eight years has there been any appreciable amount of spraying for codling moth. Through the efforts of the Experiment Station of the University of California the local difficulties have been overcome, and spraying may be said to have been placed on a practical basis only four years ago. Each year has seen an extension of spraying, until during the present season over sixty tons of arsenate of lead have been used in the Pajaro Valley on about 95% of the acreage in apples, all of it within ten miles of the city of Watsonville.

Spraying is almost entirely done with high pressure outfits, and there are certainly more power-spray outfits in this region than in any other fruit section. The complaint is not infrequently made in the East that growers will not carry out the suggestions of entomologists. This valley furnishes a conspicuous example of "applied" entomology. Most Western entomologists feel that their work is

¹1909: Titus: Journ. Ec. Ent. v. 2, p. 151.

done only when their methods become the regular practice of the growers.

The difficulties met with in the Pajaro Valley in spraying for codling moth have never been discussed except locally, and may be of interest to Eastern entomologists.

Before the investigation was taken up at Watsonville many complaints came to the Department of the burning produced by Paris green and gave occasion for the study of the greens on the market in the state, reported in Bulletin 126, in which it was shown that much of that material contained water soluble arsenic. The outcome of this study was a law defining the amount of free arsenic permissible in Paris green which was also adopted in other states and which has resulted in improving the foliage safety of Paris green all over the United States.

It was soon found that the climate about Watsonville and not the free arsenic in Paris green was the determining factor in the problem in that region.

The Pajaro Valley opens out on Monterey Bay and lies opposite the Pecheco Pass. The cold winds from the ocean blow across this valley to replace the heated air of the great San Joaquin Valley, just as the winds sweep through the Golden Gate at San Francisco towards the Sacramento Valley. In consequence there are almost daily fogs from the ocean every evening during all the summer. The continual drenching of the trees by these fogs hydrolizes almost all arsenicals, setting free the acid, and after two years of experiment involving losses of thousands of dollars in some orchards on account of arsenic injury to foliage, Paris green had to be discarded entirely.

During the third year of the investigation it was also clearly seen that none of the commercial brands of arsenate of lead could be safely used in the Valley and that in the following years hundreds of arsenicals were made up and tested and the solution of the problem finally came from the discovery that certain samples of lead arsenate, both as obtained on the market and made up in the laboratory did not injure foliage, and that these samples were distinguishable by the fact that they contained no arsenic acid soluble in ammonia, that is, they consisted of a saturated lead salt. Nearly always by the ordinary methods of manufacture an arsenate of lead consists of an acid salt or a mixture of an acid and a basic arsenate of lead.

Two of my assistants undertook to work out, as a private venture, a method of manufacture by which a uniform product of this character could be obtained. They were entirely successful and organized the California Spray Chemical Company, largely financed by local orchardists, the product of which has contributed in no small degree to the final success of the effort to control this insect.

Besides the smaller experiments many tons each of such good commercial brands of arsenate of lead as Swift's, Lavenburg's and Sherwin-Williams' have been tried in the Valley and in each case with disastrous results.

Not only does the control of the codling moth require a special kind of lead arsenate, but the spraying program presents striking peculiarities.

At this time when such good results are reported as coming from a return to the old idea of a single thorough blossom-cup spraying, and some entomologists are contending that all later sprayings should be eliminated, it may come as a surprise to some that the Watsonville spraying program, which, in the hands of our best orchardists gives as good results as are obtained anywhere, absolutely ignores the blossom-cup work.

A small portion of the valley is naturally immune. The portion between Watsonville and the sea is affected so early by the cold ocean winds that the moth rarely flies. At Watsonville often for a month at a time no insects of any kind are seen about electric lights. These cold winds make the Pajaro Valley produce winter apples along the seashore side by side with oranges, grape-fruit and lemons. While in most of the valley the codling moth flies often enough to lay its full quota of eggs, still its life history and the growth of the tree are profoundly modified. Thus the blossoming period extends over such a long period that the first fruit set usually are advanced so far as to render the poisoning of the cup impossible before half of the buds are open. At least three sprayings would be necessary if one wanted to fill all the blossom cups. Likewise the moth is very irregular in appearing in the spring, the emergence of overwintering individuals requiring three months from the first to the last,—more than enough time for a full generation of the more precocious to develop.

The delayed appearance of the moths in the spring results in the great majority of individuals attacking the fruit after it is already well advanced, and a very small per cent of the entrances are in the blossom cup. No real blossom-cup spraying has ever been done in the Pajaro Valley except in our experiments and they showed no results sufficient to justify the recommendation of the method.

The spraying program usually begins with an application about the time the last blossoms appear. This is usually long after the calyx lobes of all the fruit that will set have closed. This spray may be followed by one or two applications at intervals of a month or six weeks, the number varying with the season and the portion of the valley.

These sprayings simply reduce the number of worms that may attack the crop later. The first generation of worms are not con-

sidered as having any direct effect on the crop since the infested apples either drop or are removed at thinning.

Many of our orchardists make no further sprayings, but almost always to their loss. The best orchardists begin a campaign of one to three sprayings, beginning about the middle of August. There will undoubtedly be an improvement in this matter during the next year or two. Probably the amount of poison used in this section will ultimately be over a hundred tons.

Over 1,600 barrels of commercial lime-sulfur solution were used during the past winter for San José scale, and this material is now being produced in the local factory with a density of 36 degrees Beaumé, which is considerably stronger than anything in the market in the East.

There is very little scab and scarcely any use of Bordeaux mixture; there is beginning to be a little iron sulphid used with the lead for mildew and occasionally zinc arsenate replaces the lead for the first spraying where the tussock moth must be dealt with.

The minimum sprayings that give good results in any part of the Valley are three, two for the first brood and one in August, and the maximum is six, three for the spring and three in the summer, and except for the early spring applications must be a strictly neutral arsenate of lead, one containing no ammonia soluble arsenic.

The Common Name of the Black Scale (*Saissetia oleæ* Bern).—In Vol. II, No. 6, of this JOURNAL Mr. J. G. Sanders gives the common name of *Saissetia oleæ* Bern. as the "Olive Scale." He says, "the popular name 'Black Scale' has been applied to this species, but rather incorrectly, since it is usually very dark brown; the above name should be applied properly to *Saissetia nigra*, which in the adult female stage usually becomes truly black."

This brings up the question of the real usefulness of common names for insects. It is true that from its specific name "*oleæ*" and also its avidity to attack the olive it should be called the "Olive Scale." But since the name "Black" has become so well established, and, moreover, has been the name officially adopted by the Association of Economic Entomologists, it hardly seems wise to change it at this late date. Common names are useful chiefly to growers and others who are not entomologists. Entomologists in most cases are as familiar with the scientific name as the common name, and there is much less chance for confusion regardless of how appropriate a common name may be.

Saissetia oleæ as an economic insect in the United States is most important in California, and particularly in the southern California citrus belt. Here every grower of citrus trees knows it as the Black Scale and it would lead to needless confusion to attempt to call it anything else. On the other hand, *Saissetia nigra* Nietn. is not an economic pest anywhere in the United States, and it is of little consequence whether it has any common name at all. From the specific name "*nigra*" it could of course be appropriately called the Black Scale. But since common names are largely applied to insects of economic importance it would be likely to lead only to confusion to include the entire list of insects. While the Black Scale may not always be black, it is blacker than any others of economic importance associated with it, and to change so well established a name on a mere shade of color hardly seems justifiable.

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