

instance five *Aphycus* pupae were removed from the body of an adult black scale and three *Scutellista* pupae were taken from the egg cavity.

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## THE SUCCESSFUL INTRODUCTION AND ESTABLISHMENT OF THE LADYBIRD, *SCYMNUS BINAEVATUS* MULSANT, IN CALIFORNIA

By HARRY S. SMITH, *University of California, Citrus Experiment Station*<sup>1</sup>

## ABSTRACT

A South African ladybird, *Scymnus binaevatus*, after several unsuccessful attempts, has been colonized on several mealy bugs throughout California. There is a prospect of its becoming of considerable value as a check on these pests.

Mealybugs of several species are among the most important pests of horticulture in California, and up to the present time they have to a large extent proven resistant to all attempts at control by means of fumigation or spraying. This has made them particularly attractive subjects for control by the biological method; several valuable parasites and predators have been introduced into California for this purpose, and very satisfactory practical results have thus been secured.

Among recent introductions is that of the ladybird, *Scymnus binaevatus* Mulsant, from South Africa.

For several years the writer has been in correspondence with Mr. C. W. Mally, Entomologist for the Union of South Africa, at Capetown, with reference to a ladybird existing there, reported to be of importance as an enemy of mealybugs. When Mr. E. W. Rust, parasite collector for the State Department of Agriculture (now for the University of California) was sent to South Africa, he was asked to secure a colony of this ladybird for use in California. This he did and several shipments were made via Australia, but owing to the long journey none of them arrived in a living condition. When Mr. Rust began his return trip to this country in the fall of 1921 he brought a large colony with him

<sup>1</sup>The beneficial insect work was transferred from the California State Dept. of Agriculture to the University of California on July 1. The introduction described in this paper took place before that time.

as far as Sydney, Australia, where, owing to the necessity of making further investigations in that locality, he placed them aboard a steamer for San Francisco. This shipment like its predecessors was unsuccessful, and immediately upon its receipt Mr. Rust was advised of the situation by cable. He had very wisely left a stock in care of Mr. Mally at Capetown and at once cabled him to send another colony to him at Sydney. This was done and by stopping at Honolulu enroute for fresh food for the ladybirds Mr. Rust was able to reach California with 29 living specimens. These were rushed to the Whittier Laboratory where they were given an opportunity to propagate, which they did so effectively that within a year approximately 250,000 were colonized throughout the state.

Mr. Rust writes as follows with reference to this species:

"In South Africa it is quite commonly encountered and does much beneficial work against various mealybugs, but in its native home it is preyed upon by a parasite which often decimates it, and so keeps it from being as effective a check on its host as would otherwise be the case. This parasite (*Homalotylus africanus* Timb.) gave a great deal of trouble in the insectary at Capetown while material was being reared for shipment to California and it was only by exercising a good deal of patience that the parasite was finally eliminated and a good clean stock of ladybirds built up for shipment. However, this was finally accomplished and the coccinellids were brought to California without their parasite, so here they should increase very rapidly, being free of their hereditary foe."

*Scymnus binaevatus* is very distinct in appearance from any California species of the genus because of its greatly elongated body. It is blackish in color with a brown spot on each elytron. The larvae are very similar to those of other species of *Scymnus*, being covered with a white, waxy secretion. This ladybird has the habit of seeking crevices in bark and other hidden places for feeding, a habit which is of especial value in the case of certain mealybugs which would otherwise escape its attack.

This ladybird has been colonized throughout the state, on *Pseudococcus citri*, *P. gahani* and *P. maritimus*. Besides southern California colonies, it has been liberated in the counties of Tulare, Fresno, Kings, San Joaquin and Alameda in northern California. The first field liberation was made in March, 1922. It has since been recovered in the orchards in abundance at Santa Monica, Pasadena, Alhambra, Oxnard, Rivera and San Fernando. As many as 50 adults have been found in a single burlap band. Recoveries so far have been made only in orchards

infested with *Citrophilus mealybug*, but insufficient search has been made in case of other infestations to justify any conclusion that it will not attack the other species. It is believed that this ladybird will become of considerable value in the control of the above mentioned species when it has had sufficient time to become thoroughly established.

Through the courtesy of Dr. L. O. Howard, specimens of this ladybird were studied by Mr. E. A. Schwarz of the National Museum, who reported as follows:

"The small *Scymnus* from South Africa is most probably identical with *Scymnus binaevatus* Mulsant (1850), described (apparently from a single specimen) from "la Cafrerie." The type is now in the Stockholm Museum. Mulsant's description agrees very well with Mr. Smith's specimens but it is not known to me at present whether or not other African species of *Scymnus* allied to *S. binaevatus* have been described by recent authors. It would be safe, therefore, to refer to the species as "*Scymnus (Sidis) binaevatus* Muls.?"

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## THE HISTORY OF HYDROCYANIC ACID GAS FUMIGATION AS AN INDEX TO PROGRESS IN ECONOMIC ENTOMOLOGY

By R. S. WOGLUM, *Entomologist, California Fruit Growers Exchange, Los Angeles, California*

### ABSTRACT

Hydrocyanic acid gas fumigation was discovered in 1886. From 1886-1893 it underwent decided improvement as a fumigant for citrus trees; 1893-1900, greenhouse, nursery stock, stored products and mill fumigation were introduced; 1907-08, orchard fumigation was standardized; 1910-13, sodium cyanide displaced potassium cyanide; 1912, portable machine generator invented; 1913-14, vacuum fumigation developed; 1916, liquid hydrocyanic acid first used for fumigating; 1923, calcium cyanide dust experimented with as fumigant.

The ascendancy of American economic entomology during the last half of the 19th century appears attributable primarily to the development of methods which offered noteworthy relief to agriculturists suffering from insect depredations. The maintenance of this supremacy in pest control has rested largely on the discovery of new or the improvement of old methods or practices. The history of hydrocyanic acid gas fumigation during its thirty-seven years of use is peculiarly illustrative of entomological progress. It appears a fitting topic at this meeting as its discovery in 1886 by Coquillett was made in Los Angeles, the first experiments being conducted in the famous Wolfskill Orchard, now displaced by the Southern Pacific Station. Much of the later progress in fumigation has also been made in Southern California.

Coquillett's discovery was the outgrowth of unsuccessful efforts to