

TRANSPORTATION OF PREDACEOUS COCCINELLIDS FROM SAIPAN TO BONIN ISLANDS AND FORMOSA¹⁾

By KAY SAKIMURA

Pineapple Experiment Station
Honolulu, Hawaii.

For the purpose of surveying the natural enemies of *Pseudococcus brevipes* (CKL.) in Saipan Island, the writer stationed there from February to May, 1934. It was observed that the predacious Coccinellids were generally so abundant as to be quite an effective check of the various Coccids. Similar conditions were not found to be existing in Formosa, Loochoo, Yap and Palau. The following are the predominant and more effective species of predators.

Cryptolaemus montrouzieri Mulsant.

Common. Found on *Trionymus sacchari*, *Ferrisia virgata* and several scales.

According to Mr. K. SHIMIZU of the Saipan Industry Experiment Station, *C. montrouzieri* had been found abundantly at the time when he was first assigned there in September 1927, though there is no record of its importation from elsewhere. In Guam, a nearby island, this well-known Australian species was imported from Hawaii during 1926 and established there,²⁾ though no mention is made of its presence has been known in Guam prior to 1926. Its existence in Saipan may also be attributable to an accidental importation from Guam, with which Saipan has a long established, intimate inter-island commerce.

1) Published with the approval of the Director as Miscellaneous Paper No. 15 of the Experiment Station of the Pineapple Producers Cooperative Association, University of Hawaii.

2) Guam Agr. Exp. Sta. Report for 1926, p. 18, 1927

Nephus sp. near *bipunctatus* KUGELANN.

Most common and numerous. Found on *P. brevipes*, *T. sacchari*, *F. virgata* and several other minor mealy bugs.

This species may be endemic here. Even if it is an imported species, it must have been imported a long time ago. According to Mr. H. YUASA of the Imperial Agricultural Experiment Station, the Saipan species differ slightly from that of Formosa. He is of the opinion that they are morphologically different.³⁾

Rodolia cardinalis (MULSANT)⁴⁾

Incidental. Found on *Icerya purchasi* Mask.

According to later Mr. SHIMIZU, *R. cardinalis* was first imported into Palau and to Saipan from Formosa by the Experiment Station in 1928. It practically cleaned up the abnormally large population of *Icerya* in a few years and also invaded Tenian, an adjacent island. Both the host and the predator are now rather scarce, and the host colonies are always found associated with the

3) Mr. H. Yuasa has checked a series of specimens of each species. These species differ entirely from the Formosan *Diomus futahoshii* Ohta and *Cryptogonus orbiculus* (GYLL.); which were thought to resemble them. There are old records respecting the importation of *Scymnus bipunctatus* KUGELANN from the Philippine Islands into California in 1910 and 1914; and of *Nephus* sp. near *bipunctatus* KUGELANN from Japan, South China and the Philippine Islands into Hawaii in 1895, 1906 and 1914. However, there is no conclusive evidence to show that the Saipan *Nephus* sp. and to the *bipunctatus* which was imported into Hawaii are identical morphologically, or in food habits, at least.

The Saipan and Formosan species were recently shipped to Hawaii as a means of combating *P. brevipes* there.

4) This species was imported into Formosa from California and Hawaii in 1909 (SHIRAKI, T. 1910. Report on the cottony cushion scale, published by The Government-General of Formosa), and established there. The published records state that the inornate form appeared there and the writer's collection from Southern Formosa are of the same form. Species found in Saipan and Galaw as well as those observed by Dr. T. ISHII, of the Imperial Agricultural Experiment Station, in Loo-choo in 1932 are *ailinornate* form. In Shizuoka Prefecture, Honshu, to which the present species was introduced from Formosa in 1911, they are the ornate form. (T. OKADA and K. YOSHIDA, (1917), issued by Department of Agriculture and Commerce, Byokingaichu-Iho, No. 3).

predator. This species was first imported into Guam from Hawaii, in 1926.⁵⁾

Cryptogonus orbiculus var. *nigripennis*, WEISE

Quite common. Found on various scales.

According to Mr. WADA of the Saipan Industry Experiment Station, this species was said to have been imported from Guam for the purpose of combating the coconut scale (*Aspidiotus destructor*), which appeared there during 1912 to 1920 with a population peak in 1916, destroying 70 per cent. of the coconut trees. There is no record of the exact date of its importation but it was probably sometime after 1923.

In Guam⁶⁾ this Coccinellid was first found associated with the coconut scale, which first appeared in epidemic numbers in 1923. It is believed that the scale existed as far back as 1911, or earlier and that the predator was probably introduced along with the host.⁷⁾ A similar mode of introduction of this predator into Saipan can be assumed. The present importation from Guam was made without the knowledge of its presence in Saipan.

Incidentally, *C. montrouzieri* and *S. bipunctatus* do not exist in Palau. *R. cardinalis* was imported from Formosa and has established there. *C. nigripennis* is also present and it seems to have been there for a long time. According to Mr. SHIMIZU, a lot of this species was shipped from Saipan by the Experiment Station in 1930. However, there is no evidence to show that they have spread solely from this imported lot.

Shipments to Bonin Islands

Following the complaint by Mr. DAIDO of the County Office of Bonin Islands that various mealy bugs were troublesome and

5) Loc. Cit.

6) Guam Agr. Exp. Sta. Report for 1924, p. 1, 1925

7) Guam Agr. Exp. Sta. Report for 1925, p. 17, 1926

Coccinellids were needed there, the writer was asked by Mr. KARIYA of the Yokohama Plant Quarantine Service to arrange for an importation of *C. montrouzieri* from Saipan, where its presence was formerly reported by Mr. SHIMIZU. The writer arranged the shipment of the Coccinellids immediately upon his arrival at Saipan.

The first shipment was sent by the S. S. "AMAGI MARU" on March 7, under room temperature, and it arrived at Yokohama without any mortality on March 10, 1934. The shipment consisted of:

<i>C. montrouzieri</i>	Adults	146
	Matured larvae	147
<i>Nephus</i> sp.	Adults	65
	Matured larvae	40
<i>R. cardinalis</i>	Adults	40
	Matured larvae	24

These were packed in a 9×11×5 inches box with the two lateral sides closed with coarse screen. Each of these boxes was provided with a tube of water, cubed sugar, tree leaves sprayed with together honey and lumber shavings. These three containers were then packed together in an 18×18×12 inches well sealed carrying shipping case box constructed to allow free ventilation through two large windows on the opposite lateral sides. (Fig. 1). The matured larvae were placed in a different compartment from that of the adults, without any food. This shipment was received



Fig. 1

by Mr. DAIDO and nursed in the laboratory because of the low outdoor temperature prevailing there at the time. Owing to the difficulty of collecting an ample supply

of the host for food, all of the colonies gradually disappeared.

A request for another shipment of *C. montrouzieri* was received in late June. The writer was then on the boat from Palau to Yokohama and found it impossible for him to give his personal attention to the shipment in Saipan. After consulting with Messrs. WADA and SHIMIZU, it was arranged to have Mr. H. FUJISHIMA, a former assistant of the writer in Saipan, make the shipment under the supervision of Mr. SHIMIZU. Subsequently 117 adults, 162 pupae and 27 larvae of *C. montrouzieri* were packed as in the first shipment and shipped by the S. S. "AMAGI MARU" on July 14. They were received on July 17, 1934 in perfect condition by Mr. DAIDO, who immediately liberated a part of the shipment on Father Island. The rest were set free on Mother Island where mealy bugs (species not mentioned) were quite prevalent on July 18.

According to Mr. DAIDO's report of October 22, 1934, the predators were well established on Mother Island and were effectively checking the mealy bug population. A later report, dated November 19, stated that they had reduced the mealy bugs materially at the original spot of liberation and that the predators were steadily spreading. Since neither the establishment nor the laboratory breeding of the Coccinellids on Father Island showed much success due to the shortage of host material, Mr. DAIDO brought several of the predators from Mother Island and liberated them on a mealy bug colony (species not mentioned) on ramié early in November. Information received to date shows that *C. montrouzieri* is safely established, at least on Mother Island.

Shipment to Formosa

The situation concerning the control of *P. brevipes* in Formosa by natural enemies, was surveyed in detail by the writer while there in the autumn and winter of 1932-1933. He found a few predacious *Coccinellids* on pineapple plants but they were insufficient

in number to serve as a reliable check of the mealy bug population. *Nephus* sp. near *bipunctatus* KUGELANN was found commonly amidst other mealy bug colonies but seldom among colonies of *P. brevipes*. In Saipan a Coccinellid closely related to the species aforementioned was found abundantly and effectively checking *P. brevipes* on pineapple plants. Thus, the above incidence seems to indicate that in addition to morphological differences, there may also be biological differences between the two species of *Nephus*. Nevertheless there are some differences in the growing conditions of pineapple plants on both islands and these may be a cause for the difference in the association of the host and the predator. In Saipan the pineapple plants grow mostly under the shade of trees and in weedy fields. In Formosa the native varieties grow under more or less similar conditions but the imported varieties are in open and clean fields. It will be interesting to try the possibility of the establishment of the Saipan strain of *Nephus* first among the native varieties of pineapples in Formosa.

The writer recommended to Mr. K. OGASAWARA of the Government-General of Formosa, the importation of the *Nephus* species of Saipan into Formosa. His request for these predators arrived too late for the writer to attend to the shipment in person so Messrs. SHIMIZU and WADA were requested to ship them to Formosa.

On August 18, 270 adults, 90 pupae and 190 larvae of *Nephus* sp. were packed into a similar container to that used for shipment to Bonin Islands, by Mr. FUJISHIMA under the supervision of Mr. SHIMIZU, and they were shipped by the S. S. "OHMI MARU." Upon arrival at Yokohama on the 23rd, they were examined and the container was modified by the writer. Then they were relayed to Keelung through Kobe, arriving there on September 1 and 5, in perfect condition. Information received on October 2 was that they were breeding satisfactorily in Taihoku, Bantan

and Taiju, and they were to be liberated later in pineapple fields of southern Formosa.

The writer acknowledges the cooperation and courtesy tendered him by Mr. A. KAMITO of the Department of Agriculture and Forestry; Mr. S. KARIYA of the Yokohama Plant Quarantine Service and by Mr. T. AKIYAMA of the Kobe Plant Quarantine Service during the shipment of predators; and to Messrs. T. WADA, K. SHIMIZU and H. FUJISHIMA of the Saipan Industry Experiment Station for their assistance in the survey work in Saipan and for the preparation of the shipments. He is also indebted to Mr. H. YUASA, Imperial Agricultural Experiment Station for the identification of the Coccinellid species.
