

Field Studies on the Parasites of *Brontispa mariana* Spaeth¹

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Field studies on the imported parasites of the Mariana coconut beetle, *Brontispa mariana* Spaeth, were conducted in the Mariana Islands from July to November 1948. This work was undertaken to determine the successful establishment of the parasites and to measure their effectiveness in controlling the host.

Investigations were confined to the areas where initial parasite liberations had been made. These included seven localities on Saipan and all the coconut plantings of any appreciable size on the island. On Rota the field work was confined to a single locality on the southeast portion of the island.

Sampling of the host population in a coconut tree was accomplished by tying together the young, center, unexpanded fronds; severing them at the base; lowering them gently to the ground; and then removing all of the pupae that could be found through close inspection. The host pupae were held in vials for 6 days, or until the parasitized material could be easily recognized and segregated. This method of obtaining samples was also used successfully on the egg and larval stages of the host.

The first samples showed that the larval-pupal parasite, *Tetrastichus brontispae* (Ferrière), (figure 1), was well established. However, the egg parasite, *Haeckeliana brontispae* Ferrière, was not recovered and apparently was unable to maintain itself in the Mariana Islands.

Trees in which original parasite colonizations were known to have been made were avoided in the sampling. It was thus evident that the parasite, *Tetrastichus brontispae*, had undergone some natural dispersion in each locality.

In order to measure the activities of the parasites over a definite period of time, the sampling conducted in July was repeated in October. The comparison was made by combining the data from seven sampling stations, and then compiling the two series into table 1. From these data it appeared that *T. brontispae* was increasing its effectiveness in controlling the Mariana coconut beetle during the period from July to November. This was considered encouraging in view of the fact that the months under consideration were quite rainy and characterized by weather conditions generally unfavorable to optimum parasite activities. In November

¹ A project undertaken by the Pacific Science Board, Insect Control Committee for Micronesia, at the request of the United States Navy. Collecting was done on a survey made under the auspices of the Insect Control Committee for Micronesia of the Pacific Science Board, National Research Council, with financial assistance from the Office of Naval Research.

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a sample was taken on the island of Rota which indicated 75 per cent parasitism of the beetle pupae by *Tetrastichus*, however, the sample was too small to be considered as a reliable index of the parasite activities. This sample was taken only to determine that the establishment was successful on Rota.

Tetrastichus brontispae attacks both the larval and pupal stages of *Brontispa mariana*. The parasitized beetle larvae usually pupate before succumbing to their internal, gregarious parasites. Although emphasis in field sampling was placed upon the pupal stage of *Brontispa*, it was felt desirable to investigate the status of *Tetrastichus* on the larval stage of its host. The data from this investigation are compiled in table 2.

Table 1.—Field Parasitism of *Brontispa* Pupae—Saipan

Series	No. Pupae	No. Parasitized	No. ³ Dead	Per Cent Parasitized	Per Cent Dead	Per Cent Maturing
July 1948	389	130	35	31.3	9.0	59.7
Oct. 1948	367	222	33	60.4	8.9	30.7

³ In each sample several pupae died from undetermined causes. This was found to be a rather constant factor at about 9 per cent. The author chooses to term it normal mortality. It occurred at the same level in areas where the parasites were not present.

Table 2.—Field Parasitism of *Brontispa* Larvae—Saipan

Locality	Date	No. Larvae	No. Parasitized	Per Cent Parasitism	Per Cent Pupal Parasitism Same Tree
Aslito. (Finasisu)	Oct. 25	33	1	3.0	2.4
Canat i Etdot	Oct. 26	7	2	28.5	36.2
Chalan Kiya	Oct. 27	15	8	53.3	72.6
Magicienne Bay	Oct. 26	22	17	77.2	89.6

From these data it is evident that most of the beetle pupae found parasitized in the field were attacked by *Tetrastichus* while in the larval stage. The fact that *Tetrastichus* also attacks the pupae increases the effectiveness of the parasite and the vulnerability of the host.

At Magicienne Bay, Saipan, where parasite activity was particularly high (larvae 77 per cent, pupae 89 per cent), a number of larvae were found to be parasitized and to die before pupating. Quite a number of these did not produce adult parasites although dissections revealed the body cavity to be filled with larval *Tetrastichus*. These killed larvae constituted 13 per cent of the total host sample, and would be completely overlooked by the normal sampling procedure. The fact that this mortality results from the attack of *Tetrastichus* suggests an even greater degree of parasite effectiveness than is reflected in data taken solely from the pupae.

Field studies revealed that *T. brontispae* possesses several attributes which often characterize an efficient natural enemy: (1) The life cycle is relatively short, and in the Mariana Islands there are two generations

of the parasite to each single generation of the host. (2) The parasite prefers to occupy the same area of the palm tree inhabited by *Brontispa*. (3) The power of dispersion of the parasite seems to be at least equal to that of the beetle. (4) Both larval and pupal stages of the host are attacked by the parasites. (5) *T. brontispae* is able to maintain its effective activity during the wet season. (6) The parasite is gregarious, and since each single brood usually consists of both sexes the conditions are favorable for mating and for producing an optimum sex ratio.

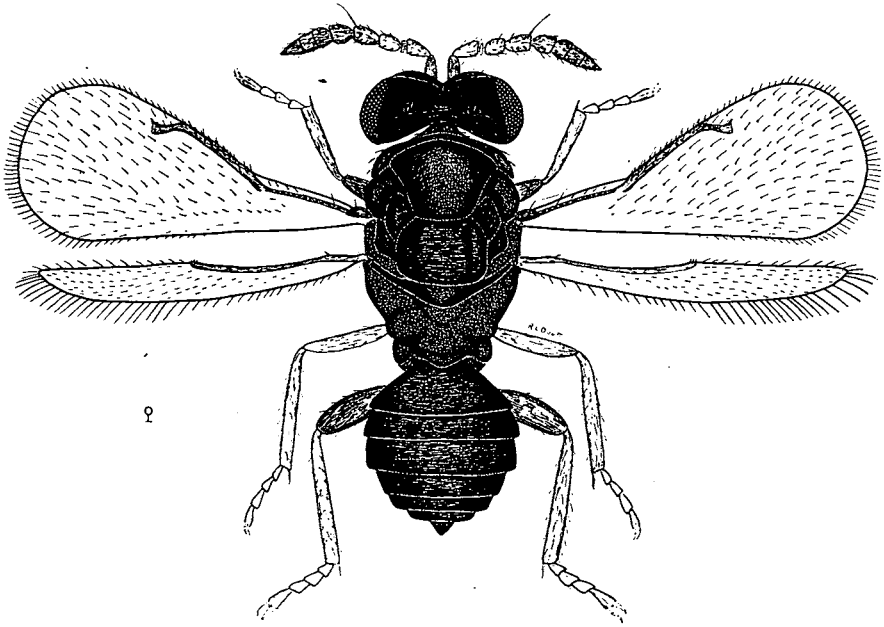


Figure 1.—*Tetrastichus brontispae* (Ferrière). Female, greatly enlarged.

In order to hasten the spread of the parasites and to effect their establishment in new localities, 5425 adult *Tetrastichus* reared from field collected material were distributed throughout the coconut plantings on the islands of Saipan, Rota, and Anatahan from August to December 1948.

Observations on infestations of *Brontispa mariana*, both in the Caroline Islands and in the Mariana Islands, indicated that the beetle attack must be severe and sustained to be lethal to the coconut palm. It appears that the tremendous recuperative power of the tree will overcome the pest if the beetle population can be reduced periodically by some agent. From the field data presented herein it seems that *Tetrastichus* is able to effect a substantial reduction in the host population. It is quite possible that this suppression of the coconut beetles may be sufficient to permit the coconut palms on Saipan to recover and grow in a normal manner.

Summary: Field investigations on parasites of the Mariana coconut beetle, *Brontispa mariana* Spaeth, disclosed that the larval-pupal parasite, *Tetrastichus brontispae* (Ferrière), was well established on the islands of Rota and Saipan but that the egg parasite, *Haeckeliana brontispae* Ferrière, had failed to maintain itself.

Field studies also indicated that parasitism by *T. brontispae* increased from a mean percentage of 31.3 in July 1948 to 60.4 per cent by the first of November. Furthermore, this increase occurred during a period of months having weather conditions generally unfavorable to parasite activities. On Rota Island 75 per cent of the beetle pupae in a small sample were found to be parasitized by *T. brontispae*.

Additional data showed that most of the beetle pupae found parasitized in the field were attacked by *Tetrastichus* while in the larval stage. Studies indicated further that *T. brontispae* possesses many attributes characteristic of an effective natural enemy.

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Observations in the Mariana and Caroline Islands suggested that the coconut palms are killed only after a severe and sustained attack by *B. mariana*. The recuperative power of the palm will apparently overcome the beetle if its populations can at least periodically be reduced. Since *T. brontispae* was shown to be capable of effecting a substantial reduction in the pest population, it is possible that the coconut palms on Saipan will be able to recover and grow in a normal manner.